ARCELOR LONG COMMERCIAL
Arcelor Group

Sheet Piling

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PROFILARBED S.A.
Arcelor Group

STEEL SHEET PILING • GENERAL CATALOGUE • EDITION 2003

METRIC/IMPERIAL UNITS • EDITION 2003

NEW SECTIONS

HOT ROLLED STEEL SHEET PILING

GENERAL CATALOGUE

PROFILARBED S.A.
Arcelor Group

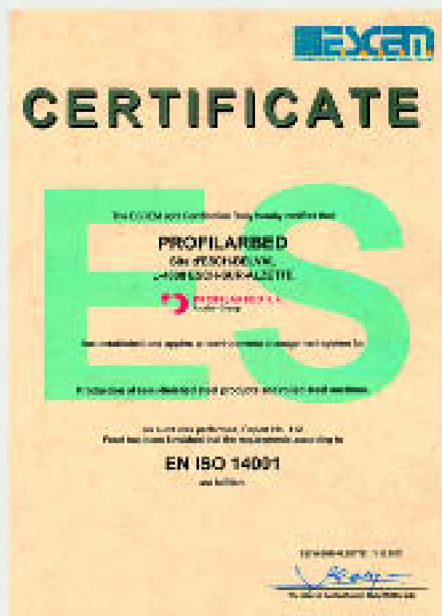
CERTIFIED ISO 9001

CONVERSION TABLE*

Dimensions	1 inch	=	2.5400 cm	1 cm	=	0.3937 in
	1 foot	=	0.3048 m	1 m	=	3.2808 ft
	1 square inch	=	6.4516 cm^2	1 cm^2	=	0.1550 sq.in
	1 square foot	=	0.0929 m^2	1 m^2	=	10.7639 sq.ft
	1 cubic inch	=	16.3870 cm^3	1 cm^3	=	0.0610 cu.in
	1 cubic foot	=	0.0283 m^3	1 m^3	=	35.3149 cu.ft
Mass, Force, Pressure	1 lb	=	4.4497 N	1 N	=	0.2247 lb
	1 lb/in	=	0.1752 N/mm	1 N/mm	=	5.7082 lb/in
	1 lb/ft	=	14.5989 N/m	1 N/m	=	0.0685 lb/ft
	1 lb/sq.in	=	0.6897 N/cm^2	1 N/cm^2	=	1.4499 lb/sq.in
	1 lb/sq.ft	=	47.8968 N/m^2	1 N/m^2	=	0.0209 lb/sq.ft
	1 lb/cu.in	=	0.2715 N/cm^3	1 N/cm^3	=	3.6827 lb/cu.in
	1 lb/cu.ft	=	157.1420 N/m^3	1 N/m^3	=	0.0064 lb/cu.ft
	1 lb	=	0.4536 kg	1 kg	=	2.2046 lbs
	1 lb/ft	=	1.4882 kg/m	1 kg/m	=	0.6720 lb/ft
	1 $lb/sq.ft^2$	=	4.8824 kg/m^2	1 kg/m^2	=	0.2048 lb/sq.ft
Moment of inertia	1 in^4	=	41.6228 cm^4	1 cm^4	=	0.0240 in^4
	1 in^4/ft	=	136.5582 cm^4/m	1 cm^4/m	=	0.0073 in^4/ft
Section modulus	1 cu.in	=	16.3870 cm^3	1 cm^3	=	0.0610 cu.in
	1 cu.in/ft	=	53.7631 cm^3/m	1 cm^3/m	=	0.0186 cu.in/ft
Moment	1 lb.ft	=	1.3563 Nm	1 Nm	=	0.7373 lb.ft
	1 lb.in/ft	=	0.3708 Nm/m	1 Nm/m	=	2.6968 lb.in/ft
	1 lb.ft/ft	=	4.4497 Nm/m	1 Nm/m	=	0.2247 lb.ft/ft

* Tables with the caracteristics of our sections in imperial units: see pages with „a“ index.

ISO 9001 CERTIFIED



ISO 14001 CERTIFIED

The "Technical Department" of ARCELOR LONG COMMERCIAL, sales organization for piling products of ProfilARBED offers owners, consulting engineers and contractors the full range of services that can be expected from a major sheet piling producer. Complimentary technical assistance is available at any stage of a project for which steel sheet piling can be used. Conceptual and preliminary designs can be worked out or reviewed, and recommendations regarding layouts and structural connections can be provided. However, the legal responsibility for the final structure remains with the owner.

Realization: ars WERBE GMBH
P108972 - 09/03

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HISTORY

ProfilARBED

ProfilARBED is the production unit for long products in the ARCELOR Group.

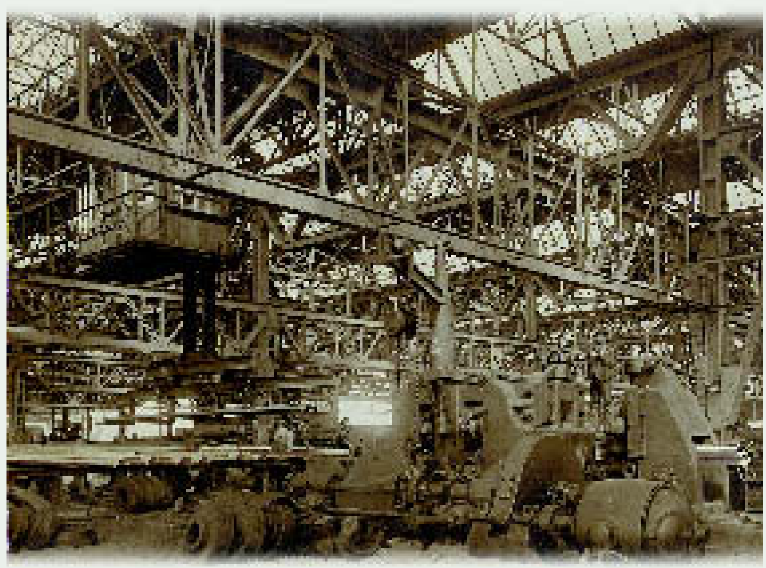
ProfilARBED is the world's first producer of sheet piles and bearing piles and has been playing a leading role in the development of piling technology for many years.

For rapid, cost-effective and reliable structures, ProfilARBED produces piling series which are mainly characterized by a good ratio of section modulus to weight and a high moment of inertia. The sheet piles are used in the construction of quays and harbors, locks and moles, bank reinforcement on rivers and canals as well as for protection of excavations on land and in water and, in general, excavation work for bridge abutments, retaining walls, foundation structures, etc.

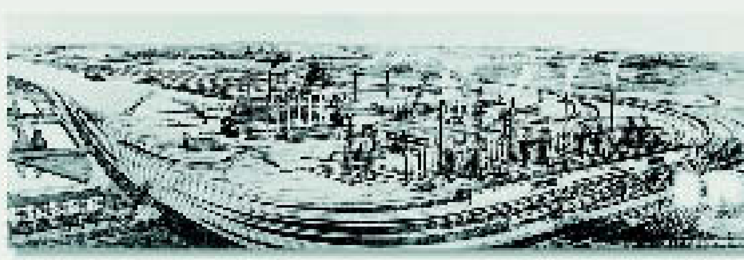
Arcelor Long Commercial Sheet Piling is the sales and marketing company for steel sheet piling and bearing piles produced by ProfilARBED.

Our Technical and Marketing Department offers comprehensive services throughout the world and customized support to all involved in the design, specification and installation of sheet and bearing piles, e.g. consulting engineers, architects, regional authorities, contractors and lecturers and their students.

The first steel sheet piles rolled in our mills were the 'Ransome' and 'Terre Rouge' piles in 1911 and 1912.



Our production program subsequently underwent constant improvement and development.

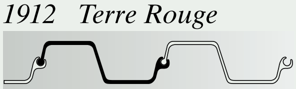


HISTORY

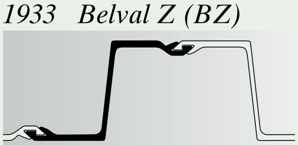
ProfilARBED

1911 Ransome

1912 Terre Rouge

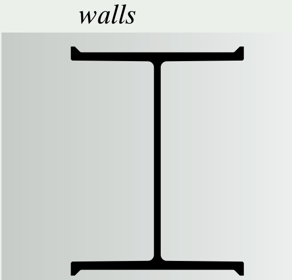


1933 Belval Z (BZ)

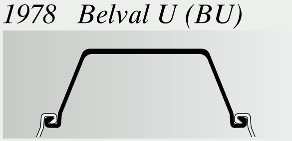


1948 Belval P (PBP)

1972 HZ for combined walls

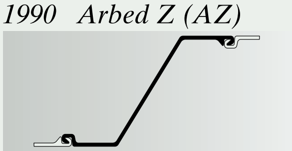


1978 Belval U (BU)

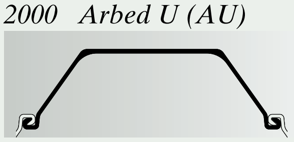


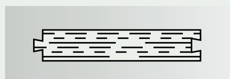
1979 Arbed Straight Web (AS 500)

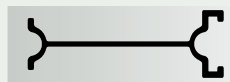
1990 Arbed Z (AZ)



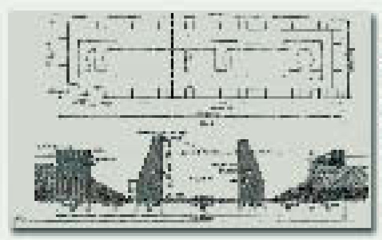
2000 Arbed U (AU)

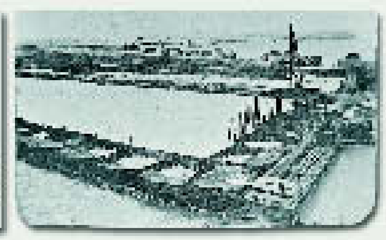




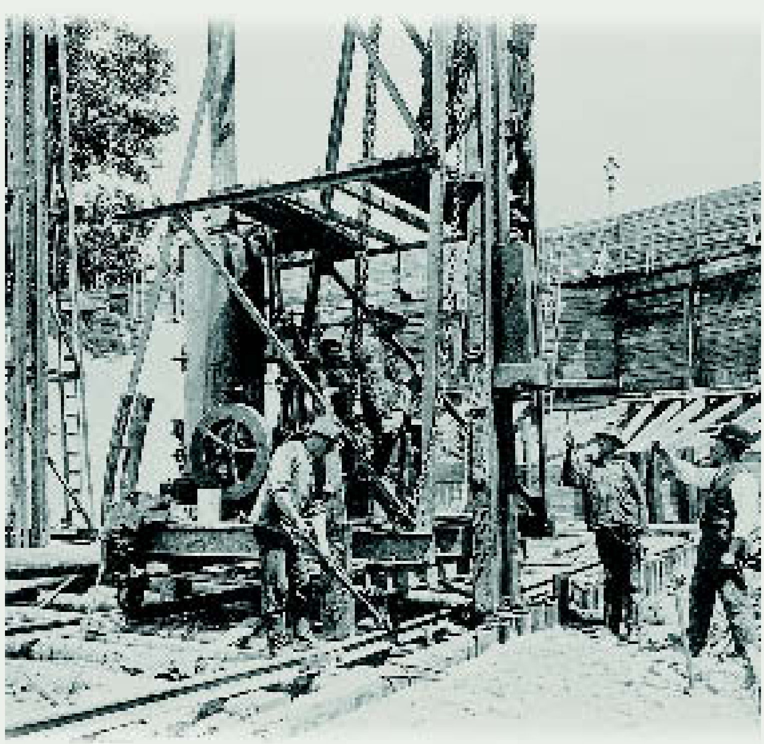


Sheet piles have been used for much longer than is normally imagined.
Historically, they have been made of wood, cast-iron, and built-up sections.
The era of steel sheet piling started with the introduction of new rolling technologies at the beginning of the 20th century.





The first big steel sheet pile project was the lock construction in Black Rock Harbor in the United States in 1908. This project used 6600 tons of Lackawanna straight web piles.



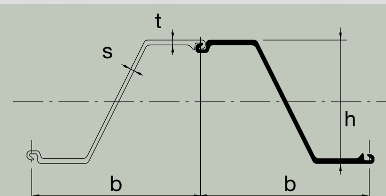
Z SECTIONS

CHARACTERISTICS

The essential characteristics of the Z sheet pile are the continuous form of the web and the specific location of the interlock symmetrically on both sides of the neutral axis. Both aspects have a positive influence on the section modulus.

The AZ series, a combination of a section with extraordinary characteristics and the proven qualities of the Larssen interlock, has the following advantages:

– an extremely competitive section modulus-to-mass ratio.
– increased inertia, reducing deflection and allowing high-yield steels to be used for the most economical solution.
– large width resulting in good installation performance.
– good corrosion resistance, the steel being thickest at the critical corrosion points.



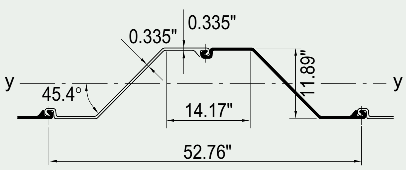
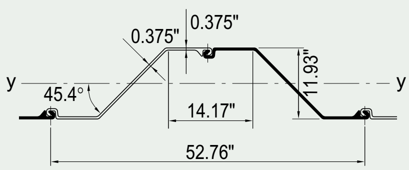
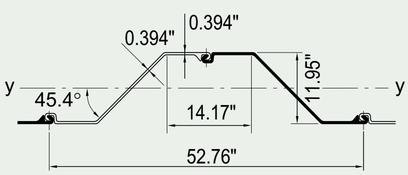
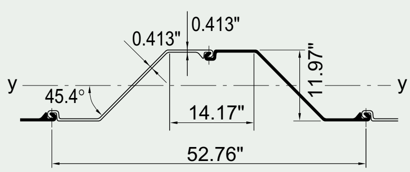
Section	Width	Height	Thickness		Sectional area	Mass		Moment of inertia	**Elastic section modulus**	Static moment	Plastic section modulus	Class*					
	b	h	t	s		lb/ft of single pile	**lb/ft² of wall**					S 240	S 270	S 320	S 355	S 390	S 430
	in	in	in	in	in²/ft			in⁴/ft	**in³/ft**	in³/ft	in³/ft						
AZ 12	26.38	11.89	0.335	0.335	5.94	44.42	**20.22**	132.8	**22.3**	13.1	26.2	2	3	3	3	3	3
AZ 13	26.38	11.93	0.375	0.375	6.47	48.38	**22.02**	144.3	**24.2**	14.2	28.4	2	2	2	3	3	3
AZ 14	26.38	11.97	0.413	0.413	7.03	52.62	**23.94**	156.0	**26.0**	15.3	30.7	2	2	2	2	2	3
AZ 17	24.80	14.92	0.335	0.335	6.53	45.96	**22.24**	231.3	**31.0**	18.0	36.2	2	2	3	3	3	3
AZ 18	24.80	14.96	0.375	0.375	7.11	49.99	**24.19**	250.4	**33.5**	19.5	39.1	2	2	2	3	3	3
AZ 19	24.80	15.00	0.413	0.413	7.74	54.43	**26.34**	270.8	**36.1**	21.2	42.3	2	2	2	2	2	2
AZ 25	24.80	16.77	0.472	0.441	8.74	61.49	**29.74**	382.6	**45.7**	26.7	53.4	2	2	2	2	2	2
AZ 26	24.80	16.81	0.512	0.480	9.35	65.72	**31.79**	406.5	**48.4**	28.5	56.9	2	2	2	2	2	2
AZ 28	24.80	16.85	0.551	0.520	9.97	70.15	**33.94**	431.6	**51.2**	30.2	60.5	2	2	2	2	2	2
AZ 34	24.80	18.07	0.669	0.512	11.03	77.61	**37.54**	576.3	**63.8**	37.0	74.0	2	2	2	2	2	2
AZ 36	24.80	18.11	0.709	0.551	11.67	82.11	**39.73**	606.3	**67.0**	39.1	78.0	2	2	2	2	2	2
AZ 38	24.80	18.15	0.748	0.591	12.33	86.75	**41.97**	637.7	**70.3**	41.1	82.2	2	2	2	2	2	2
AZ 46	22.83	18.94	0.709	0.551	13.76	89.10	**46.82**	808.8	**85.5**	49.3	98.5	2	2	2	2	2	2
AZ 48	22.83	18.98	0.748	0.591	14.48	93.81	**49.28**	847.1	**89.3**	51.6	103.3	2	2	2	2	2	2
AZ 50	22.83	19.02	0.787	0.630	15.22	98.58	**51.80**	886.5	**93.3**	54.1	108.2	2	2	2	2	2	2
For minimum steel thicknesses of 0.394 in (10 mm):																	
AZ 13 10/10	26.38	11.95	0.394	0.394	6.76	50.53	**22.98**	150.0	**25.1**	14.8	29.6	2	2	2	2	3	3
AZ 18 10/10	24.80	14.98	0.394	0.394	7.43	52.28	**25.27**	260.3	**34.8**	20.4	40.7	2	2	2	2	2	3
For minimum steel thicknesses of 0.5 in (12.7 mm):																	
AZ 26 + 0.5	24.80	16.83	0.531	0.500	9.66	67.94	**32.87**	419.2	**49.8**	29.3	58.7	2	2	2	2	2	2

*: Classification according to ENV 1993-5.
Class 1 is obtained by verification of the rotation capacity for a class-2 cross-section.

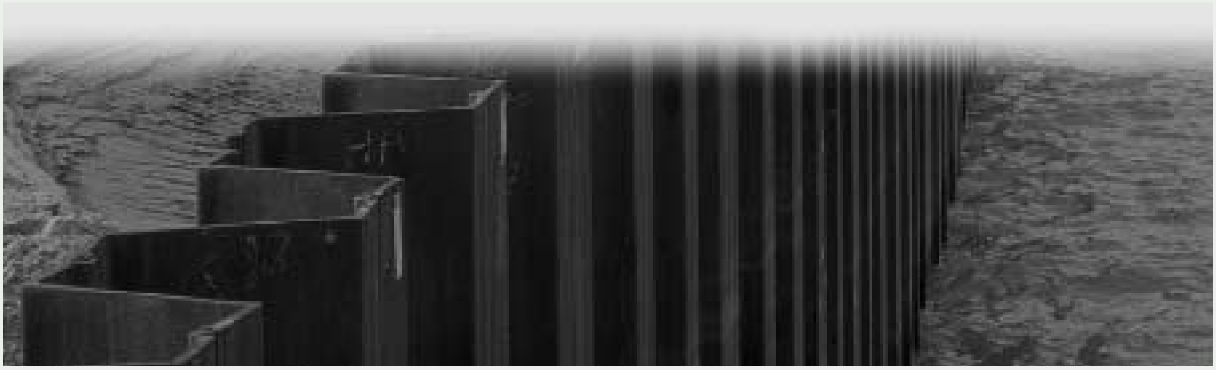
A set of tables with all the data required for design in accordance with ENV 1993-5 is available from our Technical Department.

Z SECTIONS

CHARACTERISTICS

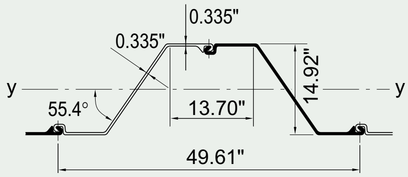
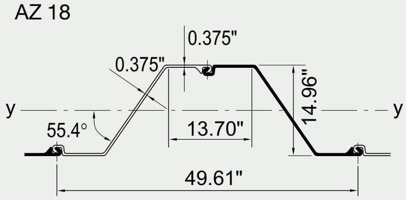
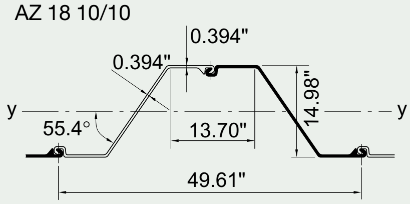
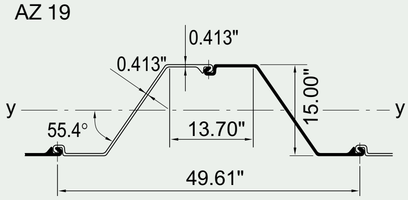
Section	S = Single pile D = Double pile	Sectional area in²	**Mass**	Moment of inertia in⁴	**Elastic section modulus** **in³**	Radius of gyration in	Coating area* ft²/ft
AZ 12							
	Per S	13.05	**44.42 lb/ft**	292.1	**49.1**	4.73	2.72
	Per D	26.10	**88.83 lb/ft**	584.3	**98.2**	4.73	5.41
	Per ft of wall	5.94	**20.22 lb/ft²**	132.8	**22.3**	4.73	1.23
AZ 13							
	Per S	14.21	**48.38 lb/ft**	317.1	**53.1**	4.72	2.72
	Per D	28.43	**96.76 lb/ft**	634.3	**106.2**	4.72	5.41
	Per ft of wall	6.47	**22.02 lb/ft²**	144.3	**24.2**	4.72	1.23
AZ 13 10/10							
	Per S	14.85	**50.53 lb/ft**	329.6	**55.2**	4.71	2.72
	Per D	29.70	**101.06 lb/ft**	659.2	**110.5**	4.71	5.41
	Per ft of wall	6.76	**22.98 lb/ft²**	150.0	**25.1**	4.71	1.23
AZ 14							
	Per S	15.45	**52.62 lb/ft**	342.8	**57.3**	4.71	2.72
	Per D	30.91	**105.23 lb/ft**	685.7	**114.7**	4.71	5.41
	Per ft of wall	7.03	**23.94 lb/ft²**	156.0	**26.0**	4.71	1.23

* One side, excluding inside of interlocks.



Z SECTIONS

CHARACTERISTICS

Section	S = Single pile D = Double pile	Sectional area in²	**Mass**	Moment of inertia in⁴	**Elastic section modulus** **in³**	Radius of gyration in	Coating area* ft²/ft
AZ 17 	Per S	13.50	**45.96 lb/ft**	478.1	**64.1**	5.95	2.82
	Per D	27.00	**91.93 lb/ft**	956.2	**128.2**	5.95	5.61
	Per ft of wall	6.53	**22.24 lb/ft²**	231.3	**31.0**	5.95	1.35
AZ 18 	Per S	14.69	**49.99 lb/ft**	517.5	**69.3**	5.93	2.82
	Per D	29.39	**99.99 lb/ft**	1035.0	**138.5**	5.93	5.61
	Per ft of wall	7.11	**24.19 lb/ft²**	250.4	**33.5**	5.93	1.35
AZ 18 10/10 	Per S	15.36	**52.28 lb/ft**	537.9	**71.7**	5.92	2.82
	Per D	30.71	**104.49 lb/ft**	1076.1	**143.7**	5.92	5.61
	Per ft of wall	7.43	**25.27 lb/ft²**	260.3	**34.8**	5.92	1.35
AZ 19 	Per S	16.00	**54.43 lb/ft**	559.8	**74.6**	5.92	2.82
	Per D	31.99	**108.86 lb/ft**	1119.6	**149.2**	5.92	5.61
	Per ft of wall	7.74	**26.34 lb/ft²**	270.8	**36.1**	5.92	1.35

AZ 17 profile:

AZ 18 profile:

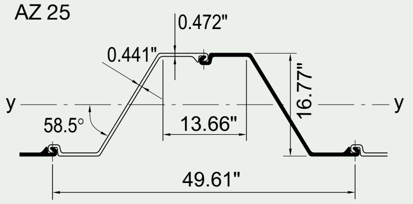
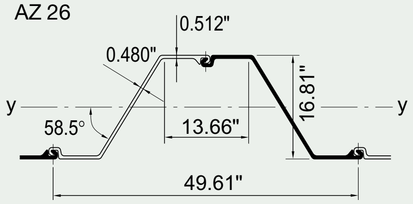
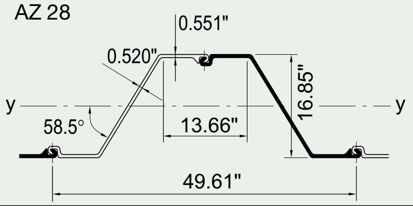
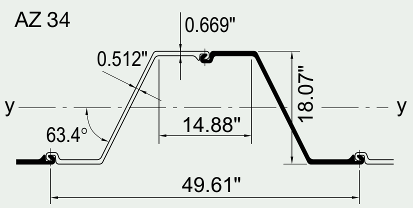
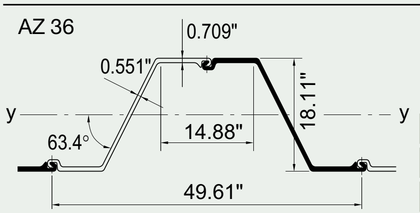
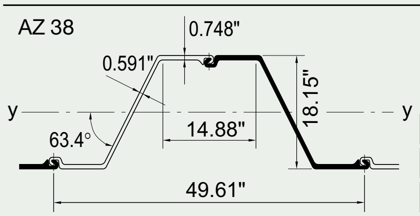
AZ 18 10/10 profile:

AZ 19 profile:

* One side, excluding inside of interlocks.

Z SECTIONS

CHARACTERISTICS

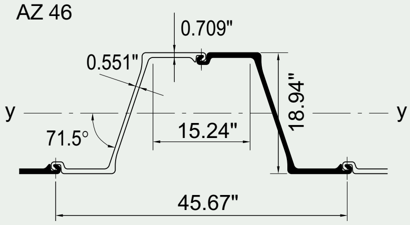
Section	S = Single pile D = Double pile	Sectional area in^2	**Mass**	Moment of inertia in^4	**Elastic section modulus** **in^3**	Radius of gyration in	Coating area* ft^2/ft
AZ 25 	Per S	18.07	**61.49 lb/ft**	790.7	**94.3**	6.61	2.95
	Per D	36.15	**122.97 lb/ft**	1581.3	**188.6**	6.61	5.84
	Per ft of wall	8.74	**29.74 lb/ft^2**	382.6	**45.7**	6.61	1.41
AZ 26 	Per S	19.31	**65.72 lb/ft**	840.2	**100.1**	6.59	2.95
	Per D	38.63	**131.44 lb/ft**	1680.3	**200.2**	6.59	5.84
	Per ft of wall	9.35	**31.79 lb/ft^2**	406.5	**48.4**	6.59	1.41
AZ 28 	Per S	20.62	**70.15 lb/ft**	892.0	**105.9**	6.58	2.95
	Per D	41.23	**140.31 lb/ft**	1784.1	**211.8**	6.58	5.84
	Per ft of wall	9.97	**33.94 lb/ft^2**	431.6	**51.2**	6.58	1.41
AZ 34 	Per S	22.80	**77.61 lb/ft**	1191.2	**131.8**	7.23	3.05
	Per D	45.60	**155.22 lb/ft**	2382.3	**263.6**	7.23	6.07
	Per ft of wall	11.03	**37.54 lb/ft^2**	576.3	**63.8**	7.23	1.47
AZ 36 	Per S	24.13	**82.11 lb/ft**	1253.1	**138.5**	7.20	3.05
	Per D	48.27	**164.23 lb/ft**	2506.3	**277.0**	7.20	6.07
	Per ft of wall	11.67	**39.73 lb/ft^2**	606.3	**67.0**	7.20	1.47
AZ 38 	Per S	25.50	**86.75 lb/ft**	1318.0	**145.2**	7.19	3.05
	Per D	51.00	**173.50 lb/ft**	2636.0	**290.5**	7.19	6.07
	Per ft of wall	12.33	**41.97 lb/ft^2**	637.7	**70.3**	7.19	1.47

* One side, excluding inside of interlocks.

Z SECTIONS

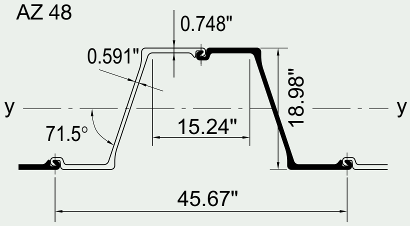
CHARACTERISTICS

AZ 46



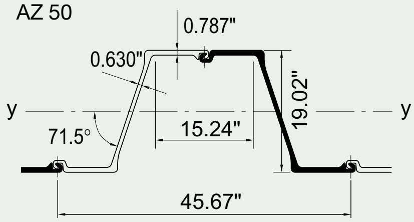
Section / S = Single pile, D = Double pile	Sectional area in²	Mass	Moment of inertia in⁴	**Elastic section modulus in³**	Radius of gyration in	Coating area* ft²/ft
Per S	26.18	**89.10 lb/ft**	1539.0	**162.6**	7.67	3.12
Per D	52.36	**178.21 lb/ft**	3078.1	**325.3**	7.67	6.20
Per ft of wall	13.76	**46.82 lb/ft²**	808.8	**85.5**	7.67	1.63

AZ 48



Section / S = Single pile, D = Double pile	Sectional area in²	Mass	Moment of inertia in⁴	**Elastic section modulus in³**	Radius of gyration in	Coating area* ft²/ft
Per S	27.56	**93.81 lb/ft**	1611.8	**170.0**	7.65	3.12
Per D	55.12	**187.61 lb/ft**	3223.7	**339.9**	7.65	6.20
Per ft of wall	14.48	**49.28 lb/ft²**	847.1	**89.3**	7.65	1.63

AZ 50

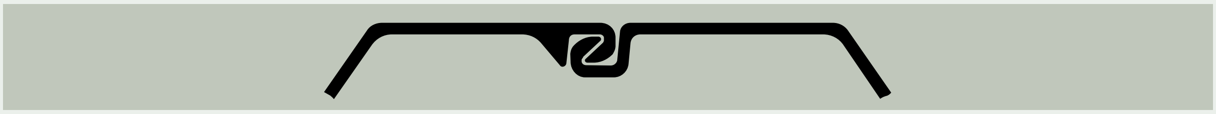


Section / S = Single pile, D = Double pile	Sectional area in²	Mass	Moment of inertia in⁴	**Elastic section modulus in³**	Radius of gyration in	Coating area* ft²/ft
Per S	28.97	**98.58 lb/ft**	1686.9	**177.6**	7.63	3.12
Per D	57.94	**197.16 lb/ft**	3373.8	**354.9**	7.63	6.20
Per ft of wall	15.22	**51.80 lb/ft²**	886.5	**93.3**	7.63	1.63

* One side, excluding inside of interlocks.

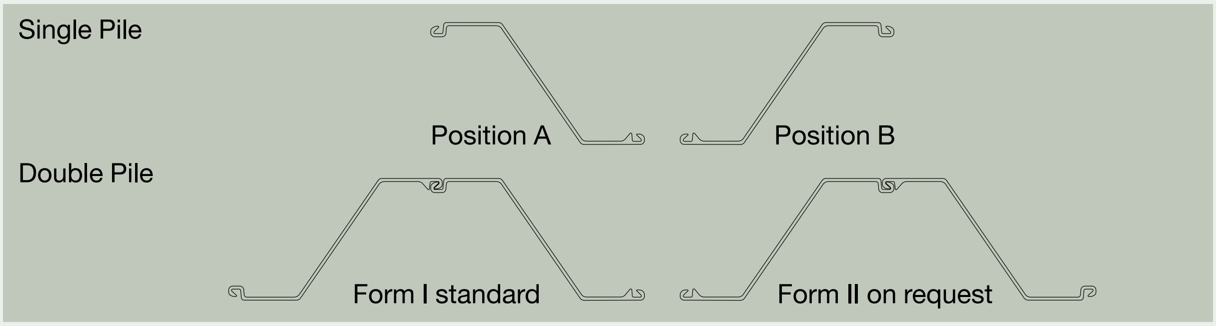
DELIVERY FORMS AND INTERLOCKING

AZ Interlock
in accordance with EN 10248

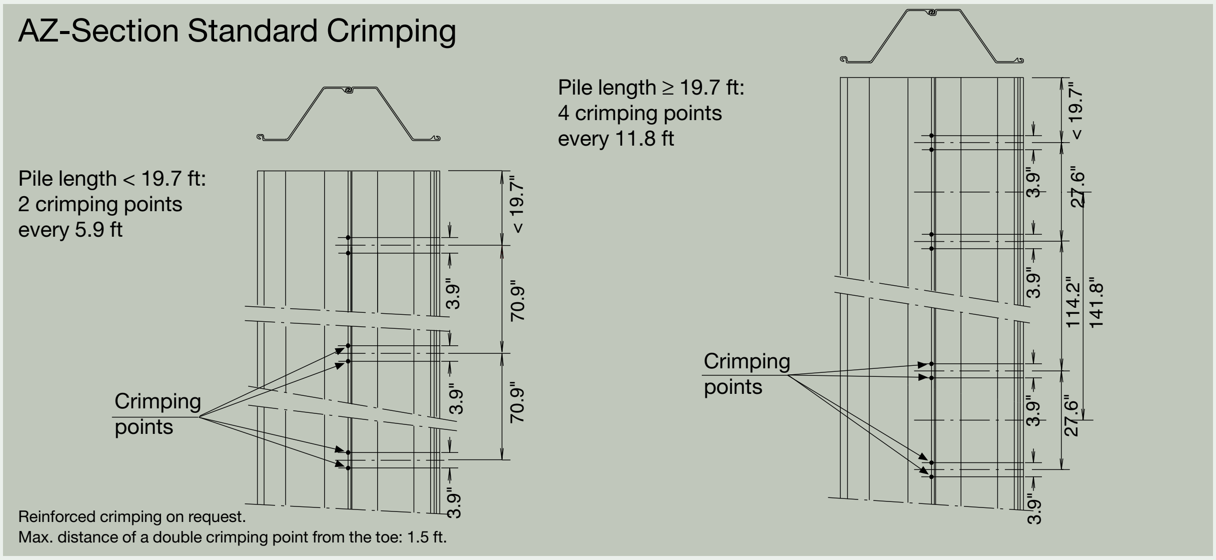


Delivery Forms

In order to comply with project-specific layout requirements, the various AZ sections can be ordered in the following configurations:



It is recommended AZ sections be used threaded to double piles. For AZ piles, fixing of the interlock of double piles is not required for static reasons. On customer request, however AZ piles may be crimped according to the following standard specification.



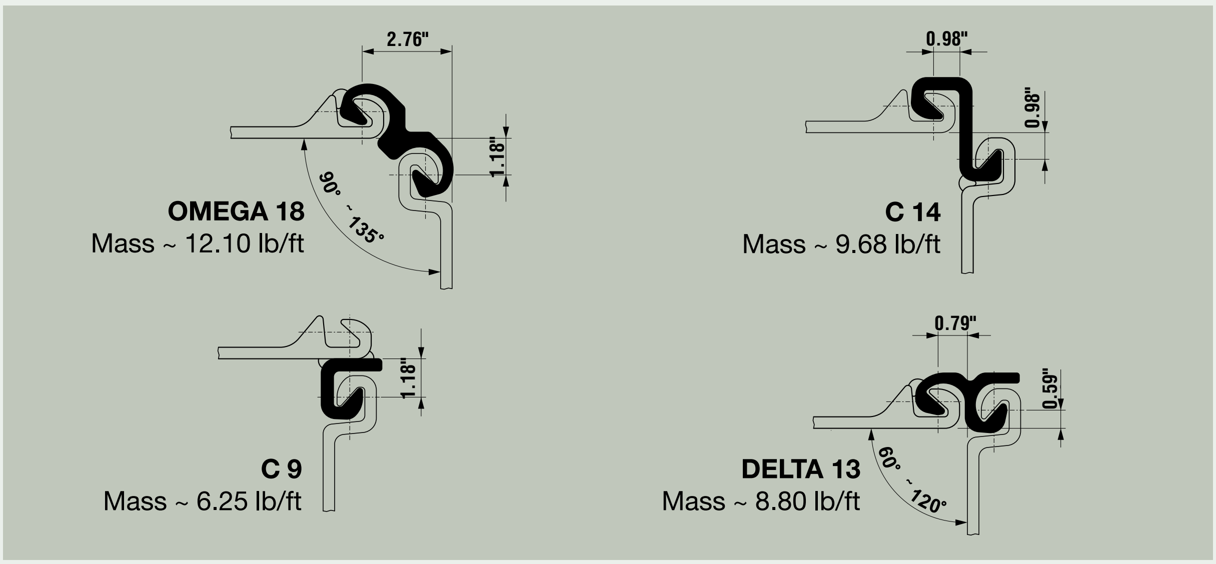
Interlocking Possibilities

The interlock of every AZ section fits into the interlock of all other hot rolled sections of the ProfilARBED production program (except straight web piles).

CORNER SECTIONS AND CORNER PILES

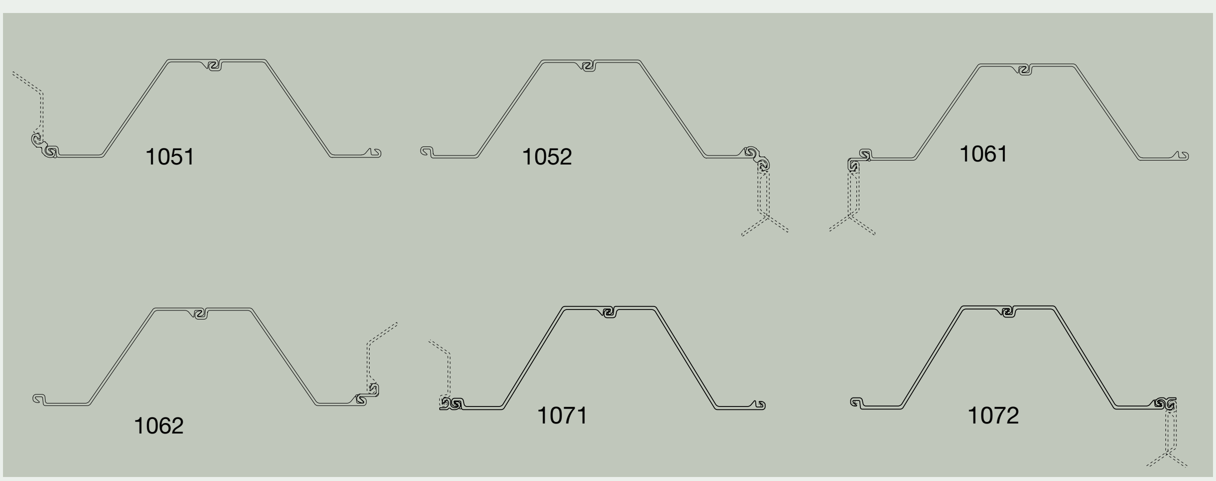
Corner Sections

Special corner sections interlocking with every section of the AZ series make it possible to form corner or junction piles without resorting to fabricated piles in most cases.



The corner sections are fixed to the main sheet pile in accordance with EN 12063.
Different welding specifications on request.
The corner sections are threaded and welded with a setback of 7.9 in from the top of the piles.

Corner Piles



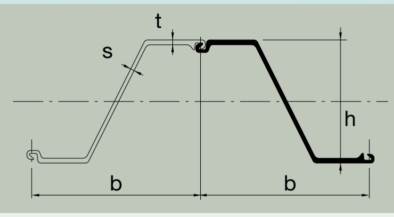
The configurations shown can be supplied as double or single piles.

CHARACTERISTICS

The essential characteristics of the Z sheet pile are the continuous form of the web and the specific location of the interlock symmetrically on both sides of the neutral axis. Both aspects have a positive influence on the section modulus.

The AZ series, a combination of a section with extraordinary characteristics and the proven qualities of the Larssen interlock, has the following advantages:

– an extremely competitive section modulus-to-mass ratio.
– increased inertia, reducing deflection and allowing high-yield steels to be used for the most economical solution.
– large width resulting in good installation performance.
– good corrosion resistance, the steel being thickest at the critical corrosion points.



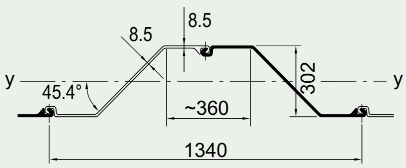
Section	Width b mm	Height h mm	Thickness t mm	Thickness s mm	Sectional area cm²/m	Mass kg/m of single pile	Mass **kg/m² of wall**	Moment of inertia cm⁴/m	**Elastic section modulus cm³/m**	Static moment cm³/m	Plastic section modulus cm³/m	Class* S 240	S 270	S 320	S 355	S 390	S 430
AZ 12	670	302	8.5	8.5	126	66.1	**99**	18140	**1200**	705	1409	2	3	3	3	3	3
AZ 13	670	303	9.5	9.5	137	72.0	**107**	19700	**1300**	765	1528	2	2	2	3	3	3
AZ 14	670	304	10.5	10.5	149	78.3	**117**	21300	**1400**	825	1651	2	2	2	2	2	3
AZ 17	630	379	8.5	8.5	138	68.4	**109**	31580	**1665**	970	1944	2	2	3	3	3	3
AZ 18	630	380	9.5	9.5	150	74.4	**118**	34200	**1800**	1050	2104	2	2	2	3	3	3
AZ 19	630	381	10.5	10.5	164	81.0	**129**	36980	**1940**	1140	2275	2	2	2	2	2	2
AZ 25	630	426	12.0	11.2	185	91.5	**145**	52250	**2455**	1435	2873	2	2	2	2	2	2
AZ 26	630	427	13.0	12.2	198	97.8	**155**	55510	**2600**	1530	3059	2	2	2	2	2	2
AZ 28	630	428	14.0	13.2	211	104.4	**166**	58940	**2755**	1625	3252	2	2	2	2	2	2
AZ 34	630	459	17.0	13.0	234	115.5	**183**	78700	**3430**	1990	3980	2	2	2	2	2	2
AZ 36	630	460	18.0	14.0	247	122.2	**194**	82800	**3600**	2100	4196	2	2	2	2	2	2
AZ 38	630	461	19.0	15.0	261	129.1	**205**	87080	**3780**	2210	4417	2	2	2	2	2	2
AZ 46	580	481	18.0	14.0	291	132.6	**229**	110450	**4595**	2650	5295	2	2	2	2	2	2
AZ 48	580	482	19.0	15.0	307	139.6	**241**	115670	**4800**	2775	5553	2	2	2	2	2	2
AZ 50	580	483	20.0	16.0	322	146.7	**253**	121060	**5015**	2910	5816	2	2	2	2	2	2
For minimum steel thicknesses of 10 mm:																	
AZ 13 10/10	670	304	10.0	10.0	143	75.2	**112**	20480	**1350**	795	1589	2	2	2	2	3	3
AZ 18 10/10	630	381	10.0	10.0	157	77.8	**123**	35540	**1870**	1095	2189	2	2	2	2	2	3
For minimum steel thicknesses of 12.7 mm:																	
AZ 26 + 0.5	630	428	13.5	12.7	204	101.1	**161**	57240	**2675**	1575	3155	2	2	2	2	2	2

*: Classification according to ENV 1993-5.
Class 1 is obtained by verification of the rotation capacity for a class-2 cross-section.

A set of tables with all the data required for design in accordance with ENV 1993-5 is available from our Technical Department.

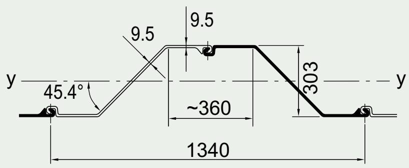
CHARACTERISTICS

AZ 12



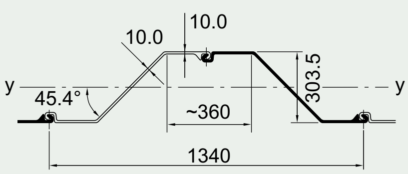
Section	S = Single pile D = Double pile	Sectional area cm²	Mass	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
AZ 12	Per S	84.2	**66.1 kg/m**	12160	**805**	12.02	0.83
	Per D	168.4	**132.2 kg/m**	24320	**1610**	12.02	1.65
	Per m of wall	125.7	**98.7 kg/m²**	18140	**1200**	12.02	1.23

AZ 13



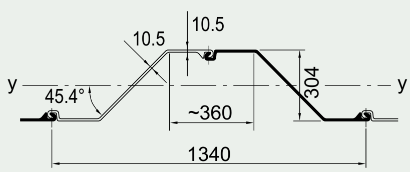
Section	S = Single pile D = Double pile	Sectional area cm²	Mass	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
AZ 13	Per S	91.7	**72.0 kg/m**	13200	**870**	11.99	0.83
	Per D	183.4	**144.0 kg/m**	26400	**1740**	11.99	1.65
	Per m of wall	136.9	**107.5 kg/m²**	19700	**1300**	11.99	1.23

AZ 13 10/10



Section	S = Single pile D = Double pile	Sectional area cm²	Mass	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
AZ 13 10/10	Per S	95.8	**75.2 kg/m**	13720	**905**	11.97	0.83
	Per D	191.6	**150.4 kg/m**	27440	**1810**	11.97	1.65
	Per m of wall	143.0	**112.2 kg/m²**	20480	**1350**	11.97	1.23

AZ 14



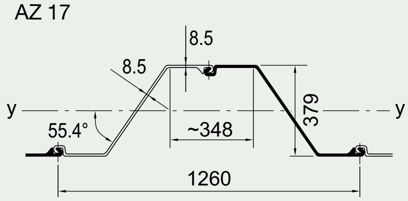
Section	S = Single pile D = Double pile	Sectional area cm²	Mass	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
AZ 14	Per S	99.7	**78.3 kg/m**	14270	**939**	11.96	0.83
	Per D	199.4	**156.6 kg/m**	28540	**1880**	11.96	1.65
	Per m of wall	148.9	**116.9 kg/m²**	21300	**1400**	11.96	1.23

* One side, excluding inside of interlocks.

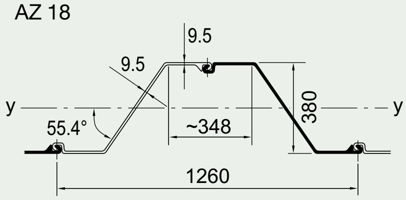
CHARACTERISTICS

Section	S = Single pile D = Double pile	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus** **cm³**	Radius of gyration cm	Coating area* m²/m
AZ 17	Per S	87.1	**68.4 kg/m**	19900	**1050**	15.12	0.86
	Per D	174.2	**136.8 kg/m**	39800	**2100**	15.12	1.71
	Per m of wall	138.3	**108.6 kg/m²**	31580	**1665**	15.12	1.35
AZ 18	Per S	94.8	**74.4 kg/m**	21540	**1135**	15.07	0.86
	Per D	189.6	**148.8 kg/m**	43080	**2270**	15.07	1.71
	Per m of wall	150.4	**118.1 kg/m²**	34200	**1800**	15.07	1.35
AZ 18 10/10	Per S	99.1	**77.8 kg/m**	22390	**1175**	15.04	0.86
	Per D	198.1	**155.5 kg/m**	44790	**2355**	15.04	1.71
	Per m of wall	157.2	**123.4 kg/m²**	35540	**1870**	15.04	1.35
AZ 19	Per S	103.2	**81.0 kg/m**	23300	**1223**	15.03	0.86
	Per D	206.4	**162.0 kg/m**	46600	**2445**	15.03	1.71
	Per m of wall	163.8	**128.6 kg/m²**	36980	**1940**	15.03	1.35

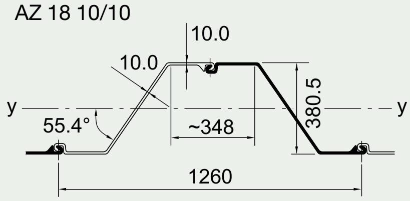
AZ 17



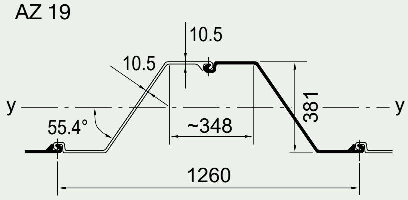
AZ 18



AZ 18 10/10



AZ 19

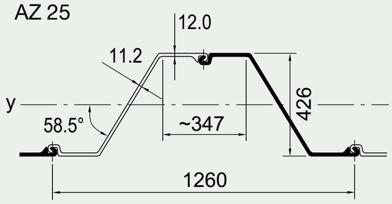


* One side, excluding inside of interlocks.

Z SECTIONS

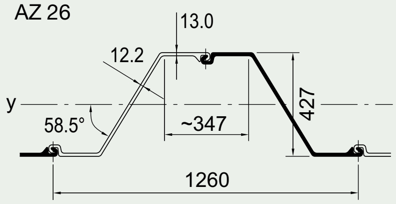
CHARACTERISTICS

AZ 25



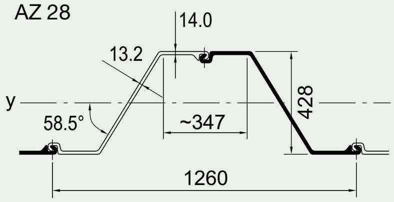
Section	S = Single pile D = Double pile	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
AZ 25	Per S	116.6	**91.5 kg/m**	32910	**1545**	16.80	0.90
	Per D	233.2	**183.0 kg/m**	65820	**3090**	16.80	1.78
	Per m of wall	185.0	**145.2 kg/m²**	52250	**2455**	16.80	1.41

AZ 26



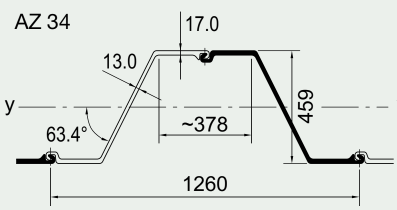
Section	S = Single pile D = Double pile	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
AZ 26	Per S	124.6	**97.8 kg/m**	34970	**1640**	16.75	0.90
	Per D	249.2	**195.6 kg/m**	69940	**3280**	16.75	1.78
	Per m of wall	198.0	**155.2 kg/m²**	55510	**2600**	16.75	1.41

AZ 28



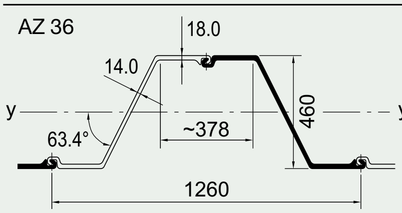
Section	S = Single pile D = Double pile	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
AZ 28	Per S	133.0	**104.4 kg/m**	37130	**1735**	16.71	0.90
	Per D	266.0	**208.8 kg/m**	74260	**3470**	16.71	1.78
	Per m of wall	211.1	**165.7 kg/m²**	58940	**2755**	16.71	1.41

AZ 34



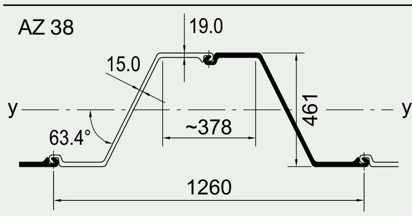
Section	S = Single pile D = Double pile	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
AZ 34	Per S	147.1	**115.5 kg/m**	49580	**2160**	18.36	0.93
	Per D	294.2	**231.0 kg/m**	99160	**4320**	18.36	1.85
	Per m of wall	233.5	**183.3 kg/m²**	78700	**3430**	18.36	1.47

AZ 36



Section	S = Single pile D = Double pile	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
AZ 36	Per S	155.7	**122.2 kg/m**	52160	**2270**	18.30	0.93
	Per D	311.4	**244.4 kg/m**	104320	**4540**	18.30	1.85
	Per m of wall	247.1	**194.0 kg/m²**	82800	**3600**	18.30	1.47

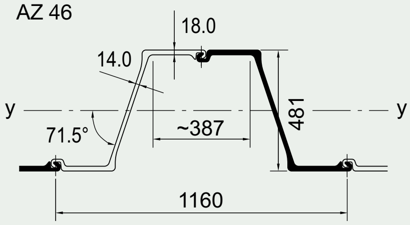
AZ 38

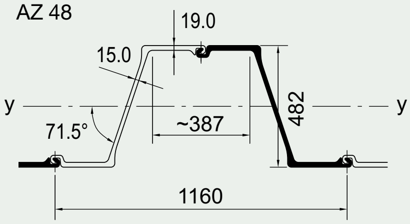


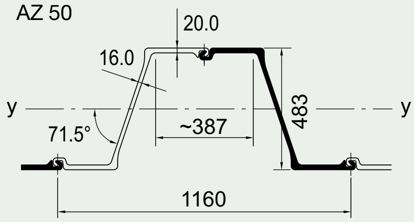
Section	S = Single pile D = Double pile	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
AZ 38	Per S	164.5	**129.1 kg/m**	54860	**2380**	18.26	0.93
	Per D	329.0	**258.2 kg/m**	109720	**4760**	18.26	1.85
	Per m of wall	261.0	**204.9 kg/m²**	87080	**3780**	18.26	1.47

* One side, excluding inside of interlocks.

CHARACTERISTICS





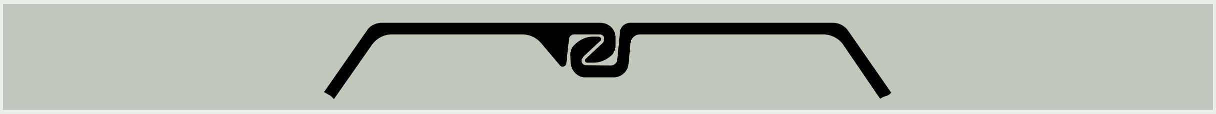


Section	S = Single pile D = Double pile	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus** **cm³**	Radius of gyration cm	Coating area* m²/m
AZ 46	Per S	168.9	**132.6 kg/m**	64060	**2665**	19.48	0.95
	Per D	337.8	**265.2 kg/m**	128120	**5330**	19.48	1.89
	Per m of wall	291.2	**228.6 kg/m²**	110450	**4595**	19.48	1.63
AZ 48	Per S	177.8	**139.6 kg/m**	67090	**2785**	19.43	0.95
	Per D	355.6	**279.2 kg/m**	134180	**5570**	19.43	1.89
	Per m of wall	306.5	**240.6 kg/m²**	115670	**4800**	19.43	1.63
AZ 50	Per S	186.9	**146.7 kg/m**	70215	**2910**	19.38	0.95
	Per D	373.8	**293.4 kg/m**	140430	**5815**	19.38	1.89
	Per m of wall	322.2	**252.9 kg/m²**	121060	**5015**	19.38	1.63

* One side, excluding inside of interlocks.

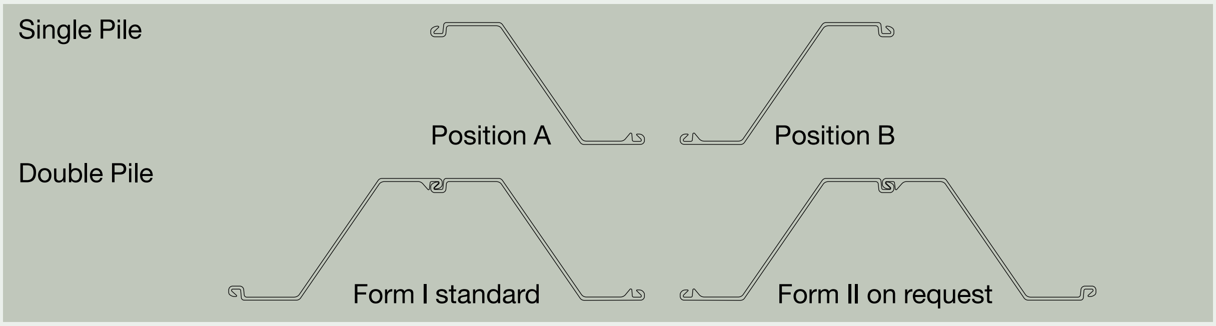
DELIVERY FORMS AND INTERLOCKING

AZ Interlock
in accordance with EN 10248

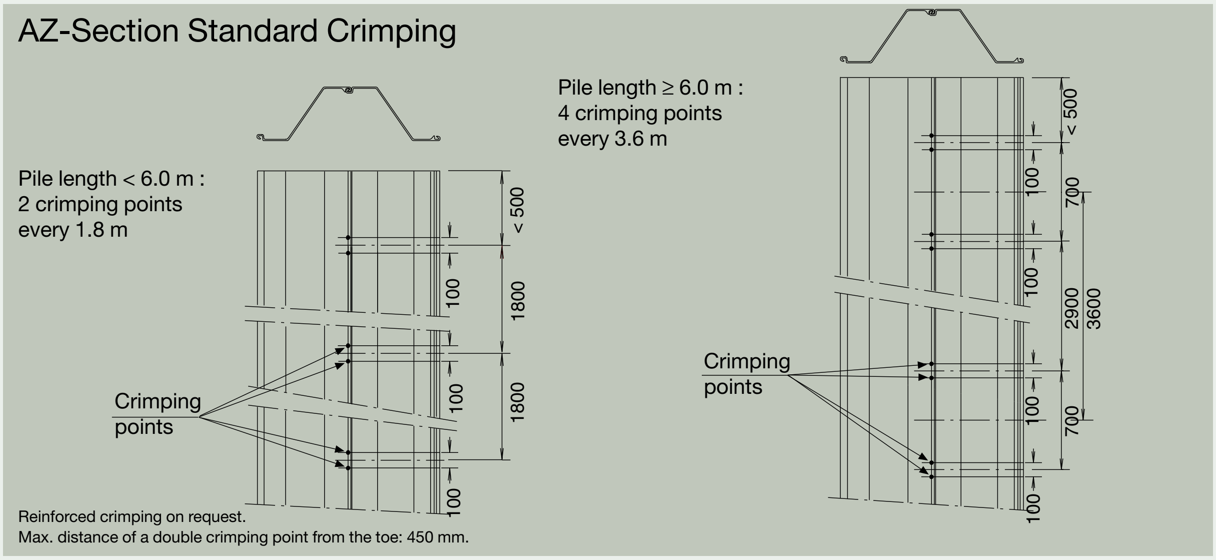


Delivery Forms

In order to comply with project-specific layout requirements, the various AZ sections can be ordered in the following configurations:



It is recommended AZ sections be used threaded to double piles. For AZ piles, fixing of the interlock of double piles is not required for static reasons. On customer request, however AZ piles may be crimped according to the following standard specification.



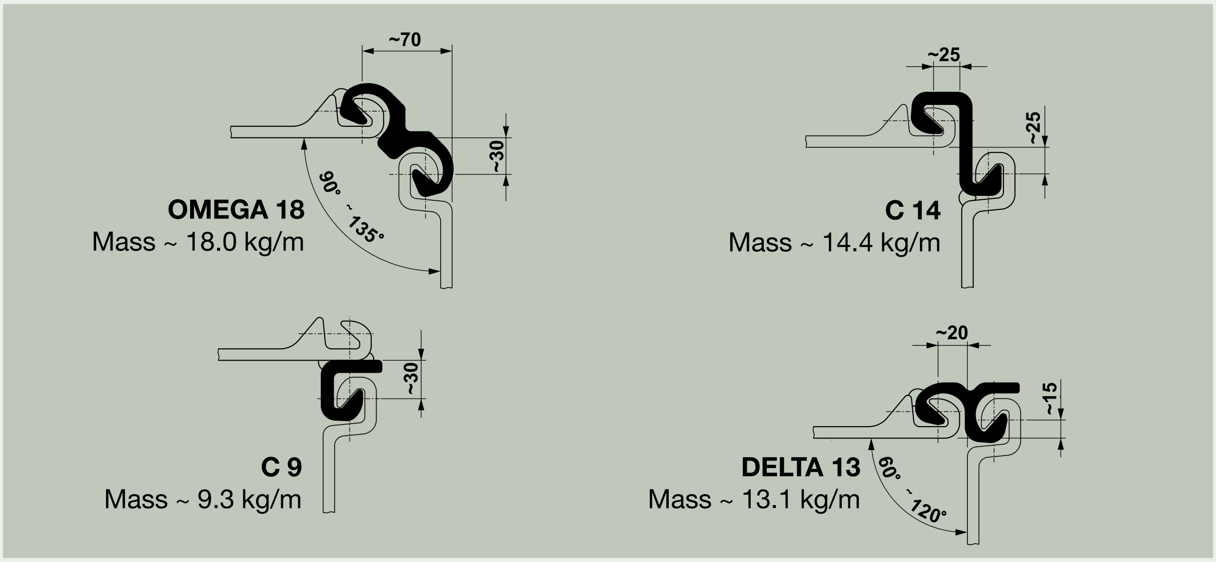
Interlocking Possibilities

The interlock of every AZ section fits into the interlock of all other hot rolled sections of the ProfilARBED production program (except straight web piles).

CORNER SECTIONS AND CORNER PILES

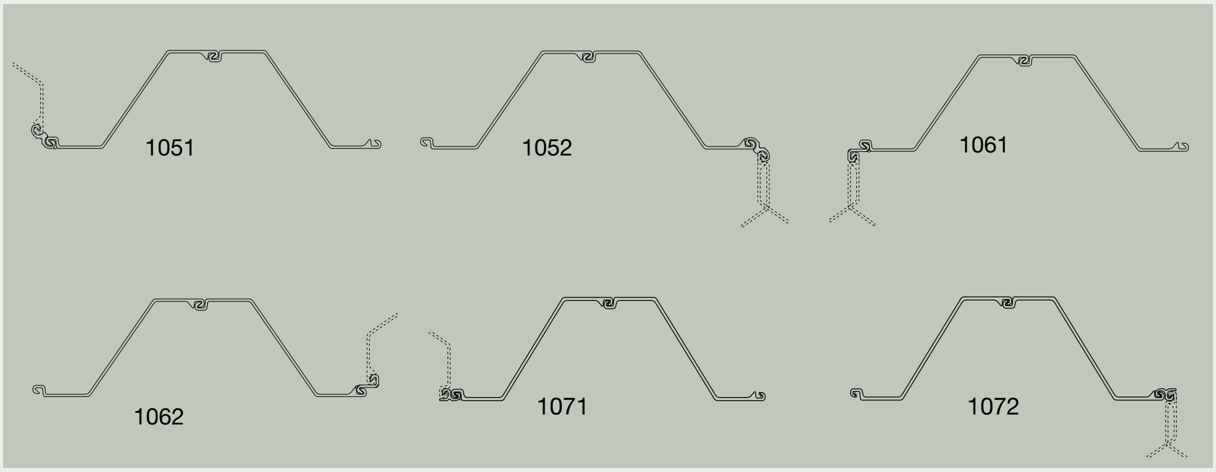
Corner Sections

Special corner sections interlocking with every section of the AZ series make it possible to form corner or junction piles without resorting to fabricated piles in most cases.



The corner sections are fixed to the main sheet pile in accordance with EN 12063.
Different welding specifications on request.
The corner sections are threaded and welded with a setback of 200 mm from the top of the piles.

Corner Piles

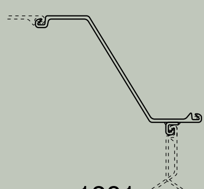


The configurations shown can be supplied as double or single piles.

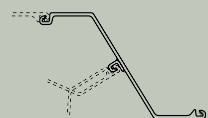
JUNCTION PILES AND CORNER PILES

The following special piles are usually delivered as single piles. Double piles upon request

Junction Piles



1201



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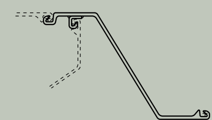

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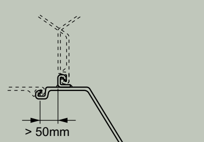

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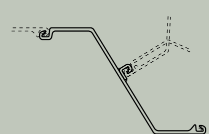

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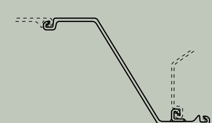
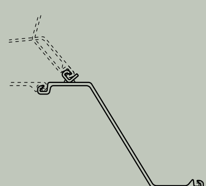


1217



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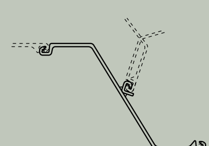

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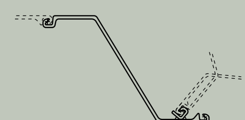
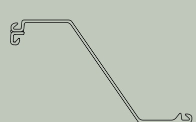
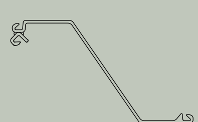


1233

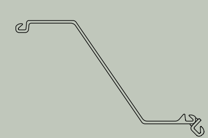
Corner Piles



1101



1102

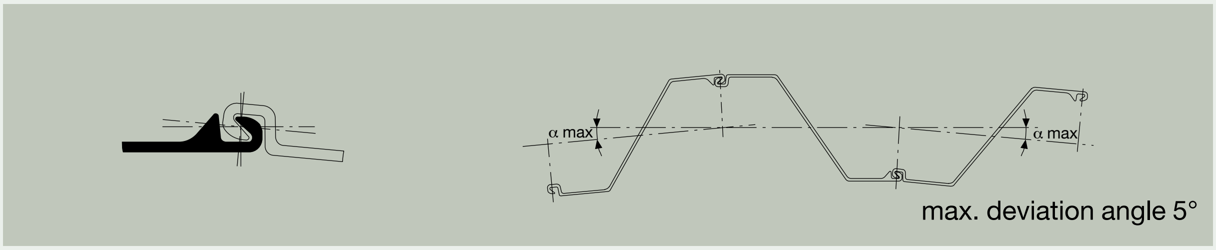


1103

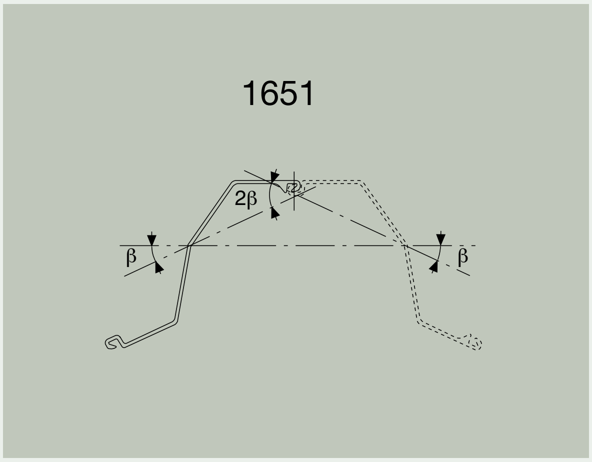
All these configurations can also be achieved with C 14, OMEGA 18 and DELTA 13 sections.
Other configurations are possible on request.

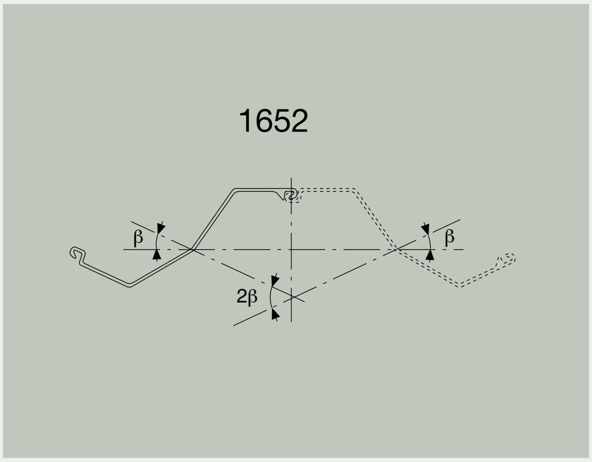
Interlock Swing

Each interlock allows a certain rotation. The maximum angle of deviation (the interlock swing) depends on the pile section and length, the soil conditions, and the installation method.
In general, the maximum deviation of an interlock is 5°.



Beyond this value the piles have to be bent.



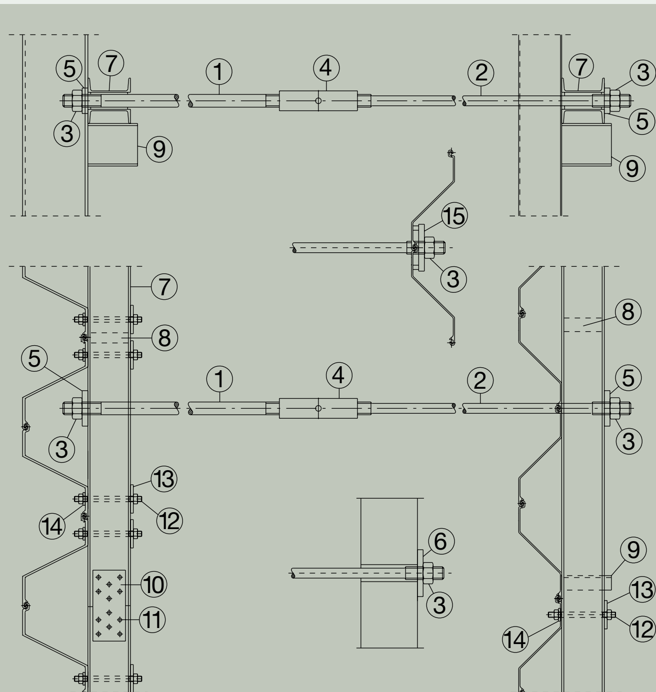


The maximum bending angle is $\beta = 25°$. The piles are bent in the middle of the web. In general, bent piles are delivered as single piles. Double piles upon request.

Tie-Back Systems

Most sheet pile retaining walls need supplementary support at the top, in addition to embedment in the soil. Temporary cofferdams generally use walers and struts for crossbracing inside the excavation. Permanent or large retaining walls are often tied back to an anchor wall installed a certain distance behind the wall.
Other anchor systems, like injection anchors or anchor piles, can also be used.

The following drawing shows a typical horizontal tie-rod connection for sheet pile walls. The following components can be seen:



1 Plain tie-rod
2 Upset end tie-rod
3 Nut
4 Turnbuckle
5 Bearing plate
6 Bearing plate on concrete
7 Waling
8 Spacer
9 Supporting console
10 Splicing plate
11 Splicing bolt
12 Fixing bolt
13, 14, 15 } Fixing plate

U SECTIONS

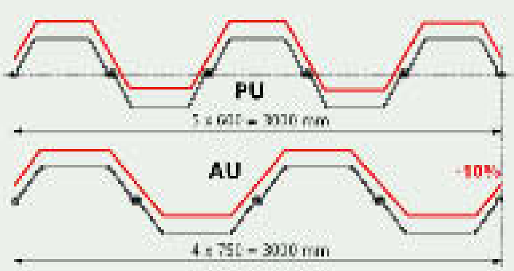
CHARACTERISTICS

The new AU series represents the following characteristics:

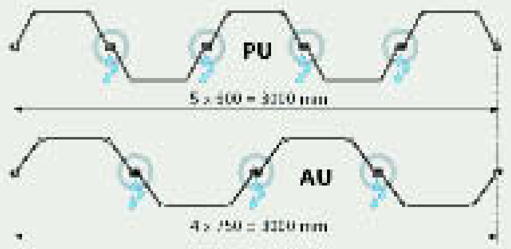
Steel savings:
by optimising the geometric dimensions, a weight reduction in mass of about 10% compared to the former PU series has been achieved. The diversity of the AU range allows you to match the specific bending resistance requirements in the most profitable way.

Improved driving efficiency:
the smooth and open shape of the new AU series and the **patented** radii at the web/flange connection reduce the required driving energy.

Increased width:
a width of 750 mm (single pile) reduces the number of elements. Installation time is also reduced.



Reduced perimeter:
due to the increased width of the pile, a 10% reduction of the perimeter has been achieved. This also cuts down the surface coating, e.g. painting.



Fewer interlocks:
the number of interlocks per linear metre of wall will also decrease. This has a direct effect on the water-tightness of the wall which is improved. The reduction in the number of interlocks also leads to a reduction in waterproofing costs (BELTAN, ROXAN, welding) if watertightness needs to be reinforced. The AU series interlocks are LARSSEN type interlocks just as used with the PU series.

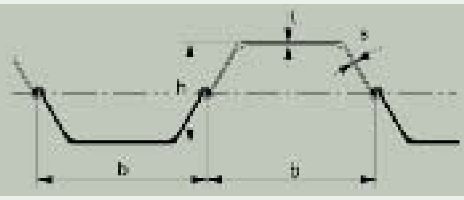
U SECTIONS

CHARACTERISTICS

Since the beginning of the last century millions of tons of U sheet piles have been used all over the world for every kind of structure.

The advantages of U piles are multiple:

– A wide range of sections forming several series with various geometrical characteristics, offering the choice of the section technically and economically best suited for a specific project.
– The combination of great wave depth with big flange thickness giving excellent statical properties.
– The symmetrical form of the single element has made these sheets particulary convenient for re-use.
– The possibility of assembling and crimping the piles to pairs in the mill provides an improvement of the installation quality and performance.
– Easy fixing of tie-rods and swivelling attachments, even under water.
– Good corrosion resistance, the biggest steel thickness lying on the outer part of the geometry



Section	Width	Height	Thickness		Sectional area	Mass		Moment of inertia	**Elastic section modulus**	Static moment	Plastic section modulus	Class*					
	b mm	h mm	t mm	s mm	cm²/m	kg/m of single pile	**kg/m² of wall**	cm⁴/m	**cm³/m**	cm³/m	cm³/m	S 240	S 270	S 320	S 355	S 390	S 430
AU 14	750	408	10.0	8.3	132	77.9	**104**	28710	**1410**	820	1663	2	2	2	2	3	3
AU 16	750	411	11.5	9.3	147	86.3	**115**	32850	**1600**	935	1891	2	2	2	2	2	2
AU 17	750	412	12.0	9.7	151	89.0	**119**	34270	**1665**	975	1968	2	2	2	2	2	2
AU 18	750	441	10.5	9.1	150	88.5	**118**	39300	**1780**	1028	2082	2	2	2	3	3	3
AU 20	750	444	12.0	10.0	165	96.9	**129**	44440	**2000**	1157	2339	2	2	2	2	2	3
AU 21	750	445	12.5	10.3	169	99.7	**133**	46180	**2075**	1200	2423	2	2	2	2	2	2
AU 23	750	447	13.0	9.5	173	102.1	**136**	50700	**2270**	1285	2600	2	2	2	2	2	3
AU 25	750	450	14.5	10.2	188	110.4	**147**	56240	**2500**	1420	2866	2	2	2	2	2	2
AU 26	750	451	15.0	10.5	192	113.2	**151**	58140	**2580**	1465	2955	2	2	2	2	2	2
PU 6	600	226	7.5	6.4	97	45.6	**76**	6780	**600**	335	697	3	3	4	4	4	4
PU 8	600	280	8.0	8.0	116	54.5	**91**	11620	**830**	480	983	3	3	3	4	4	4
PU 12	600	360	9.8	9.0	140	66.1	**110**	21600	**1200**	715	1457	2	2	2	2	2	2
PU 12 10/10	600	360	10.0	10.0	148	69.9	**116**	22580	**1255**	755	1535	2	2	2	2	2	2
PU 16	600	380	12.0	9.0	159	74.7	**124**	30400	**1600**	925	1878	2	2	2	2	2	2
PU 20	600	430	12.4	10.0	179	84.3	**140**	43000	**2000**	1165	2363	2	2	2	2	2	2
PU 25	600	452	14.2	10.0	199	93.6	**156**	56490	**2500**	1435	2899	2	2	2	2	2	2
PU 32	600	452	19.5	11.0	242	114.1	**190**	72320	**3200**	1825	3687	2	2	2	2	2	2
L 2 S	500	340	12.3	9.0	177	69.7	**139**	27200	**1600**	915	1871	2	2	2	2	2	2
L 3 S	500	400	14.1	10.0	201	78.9	**158**	40010	**2000**	1175	2389	2	2	2	2	2	2
L 4 S	500	440	15.5	10.0	219	86.2	**172**	55010	**2500**	1455	2956	2	2	2	2	2	2
JSP3	400	250	13.0	-	191	60	**150**	16800	**1340**	730	-						

The moment of inertia and section moduli values given assume correct shear transfer across the interlock.
*: Classification according to ENV 1993-5.
Class 1 is obtained by verification of the rotation capacity for a class 2 cross-section.

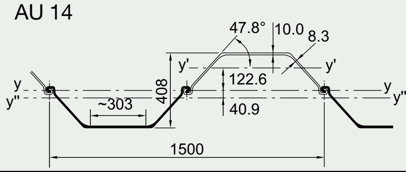
A set of tables with all the data required for design in accordance with ENV 1993-5 is available from our Technical Department.
All PU sections can be rolled-up or -down by 0.5 mm and 1.0 mm. Other sections on request.

U SECTIONS

CHARACTERISTICS

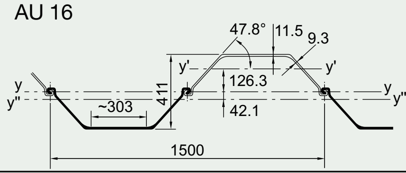
Section	S = Single pile D = Double pile T = Triple pile	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus** **cm³**	Radius of gyration cm	Coating area* m²/m

AU 14



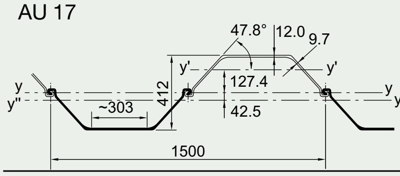
Per S	99.2	**77.9 kg/m**	6590	**456**	8.15	0.96
Per D	198.5	**155.8 kg/m**	43060	**2110**	14.73	1.91
Per T	297.7	**233.7 kg/m**	59610	**2410**	14.15	2.86
Per m of wall	132.3	**103.8 kg/m²**	28710	**1410**	14.73	1.27

AU 16



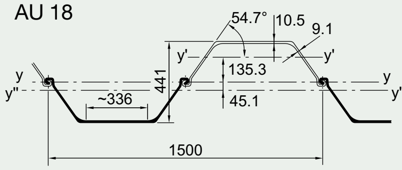
Per S	109.9	**86.3 kg/m**	7110	**481**	8.04	0.96
Per D	219.7	**172.5 kg/m**	49280	**2400**	14.98	1.91
Per T	329.6	**258.7 kg/m**	68080	**2750**	14.37	2.86
Per m of wall	146.5	**115.0 kg/m²**	32850	**1600**	14.98	1.27

AU 17



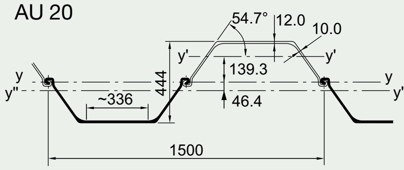
Per S	113.4	**89.0 kg/m**	7270	**488**	8.01	0.96
Per D	226.9	**178.1 kg/m**	51400	**2495**	15.05	1.91
Per T	340.3	**267.2 kg/m**	70960	**2855**	14.44	2.86
Per m of wall	151.2	**118.7 kg/m²**	34270	**1665**	15.05	1.27

AU 18



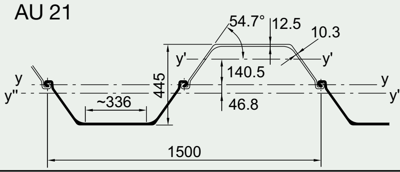
Per S	112.7	**88.5 kg/m**	8760	**554**	8.82	1.01
Per D	225.5	**177.0 kg/m**	58950	**2670**	16.17	2.00
Per T	338.2	**265.5 kg/m**	81520	**3065**	15.53	2.99
Per m of wall	150.3	**118.0 kg/m²**	39300	**1780**	16.17	1.33

AU 20



Per S	123.4	**96.9 kg/m**	9380	**579**	8.72	1.01
Per D	246.9	**193.8 kg/m**	66660	**3000**	16.43	2.00
Per T	370.3	**290.7 kg/m**	92010	**3425**	15.76	2.99
Per m of wall	164.6	**129.2 kg/m²**	44440	**2000**	16.43	1.33

AU 21



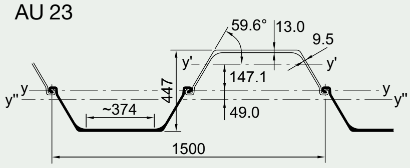
Per S	127.0	**99.7 kg/m**	9580	**588**	8.69	1.01
Per D	253.9	**199.3 kg/m**	69270	**3110**	16.52	2.00
Per T	380.9	**299.0 kg/m**	95560	**3545**	15.84	2.99
Per m of wall	169.3	**132.9 kg/m²**	46180	**2075**	16.52	1.33

– S: considered neutral axis y'-y'
– D, wall: considered neutral axis y-y
– T: considered neutral axis y"-y"

* One side, excluding inside of interlocks.

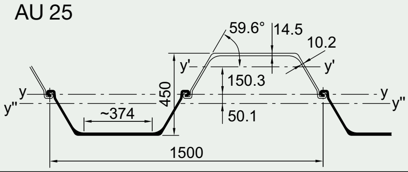
CHARACTERISTICS

AU 23



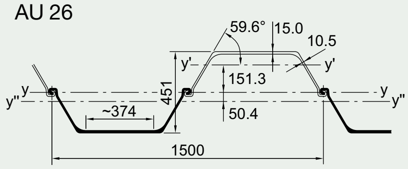
Section	S = Single pile D = Double pile T = Triple pile	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
AU 23	Per S	130.1	**102.1 kg/m**	9830	**579**	8.69	1.03
	Per D	260.1	**204.2 kg/m**	76050	**3405**	17.10	2.04
	Per T	390.2	**306.3 kg/m**	104680	**3840**	16.38	3.05
	Per m of wall	173.4	**136.1 kg/m²**	50700	**2270**	17.10	1.36

AU 25



AU 25	Per S	140.6	**110.4 kg/m**	10390	**601**	8.60	1.03
	Per D	281.3	**220.8 kg/m**	84370	**3750**	17.32	2.04
	Per T	422.0	**331.3 kg/m**	115950	**4215**	16.58	3.05
	Per m of wall	187.5	**147.2 kg/m²**	56240	**2500**	17.32	1.36

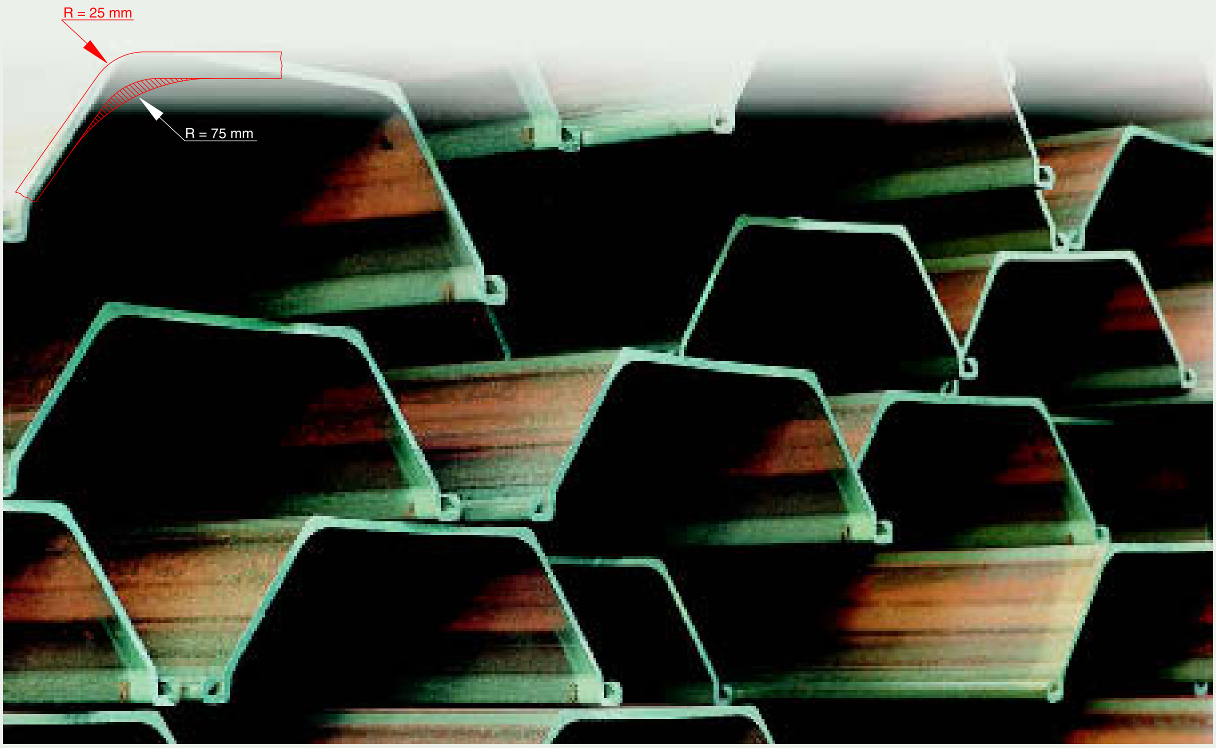
AU 26



AU 26	Per S	144.2	**113.2 kg/m**	10580	**608**	8.57	1.03
	Per D	288.4	**226.4 kg/m**	87220	**3870**	17.39	2.04
	Per T	432.6	**339.6 kg/m**	119810	**4340**	16.64	3.05
	Per m of wall	192.2	**150.9 kg/m²**	58140	**2580**	17.39	1.36

– S: considered neutral axis y'-y'
– D, wall: considered neutral axis y-y
– T: considered neutral axis y"-y"

* One side, excluding inside of interlocks.

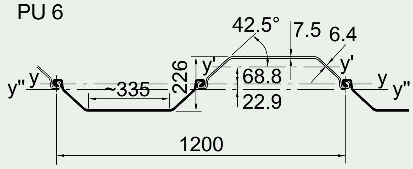


U SECTIONS

DELIVERY FORMS AND INTERLOCKING

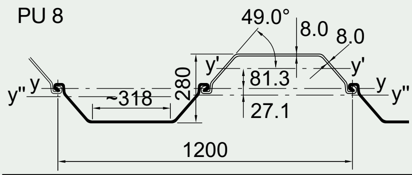
S = Single pile
D = Double pile
T = Triple pile

PU 6



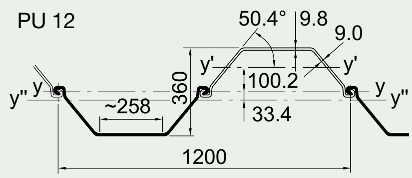
Section	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
Per S	58.1	**45.6 kg/m**	1320	**150**	4.76	0.72
Per D	116.2	**91.2 kg/m**	8130	**720**	8.37	1.43
Per T	174.3	**136.8 kg/m**	11280	**830**	8.04	2.14
Per m of wall	97.0	**76.0 kg/m²**	6780	**600**	8.37	1.19

PU 8



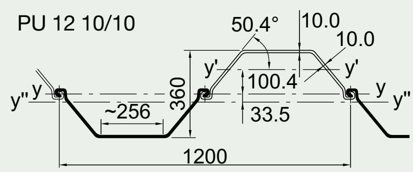
Section	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
Per S	69.5	**54.5 kg/m**	2380	**134**	5.85	0.76
Per D	139.0	**109.1 kg/m**	13940	**1000**	10.02	1.50
Per T	208.5	**163.6 kg/m**	19380	**1160**	9.64	2.25
Per m of wall	116.0	**90.9 kg/m²**	11620	**830**	10.02	1.25

PU 12



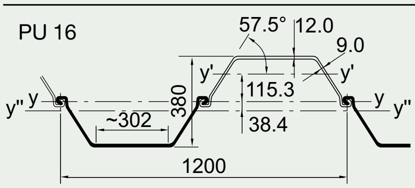
Section	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
Per S	84.2	**66.1 kg/m**	4500	**370**	7.31	0.80
Per D	168.4	**132.2 kg/m**	25920	**1440**	12.41	1.59
Per T	252.6	**198.3 kg/m**	36060	**1690**	11.95	2.38
Per m of wall	140.0	**110.1 kg/m²**	21600	**1200**	12.41	1.32

PU 12 10/10



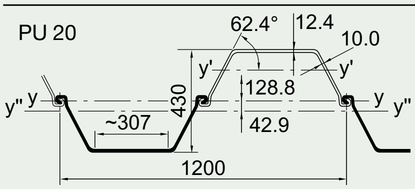
Section	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
Per S	88.7	**69.6 kg/m**	4600	**377**	7.20	0.80
Per D	177.3	**139.2 kg/m**	27100	**1505**	12.36	1.59
Per T	266.0	**208.8 kg/m**	37670	**1765**	11.90	2.38
Per m of wall	147.8	**116.0 kg/m²**	22580	**1255**	12.36	1.32

PU 16



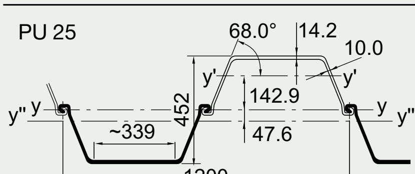
Section	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
Per S	95.2	**74.7 kg/m**	5600	**410**	7.67	0.83
Per D	190.3	**149.4 kg/m**	36490	**1920**	13.85	1.65
Per T	285.5	**224.1 kg/m**	50510	**2210**	13.30	2.48
Per m of wall	159.0	**124.5 kg/m²**	30400	**1600**	13.85	1.37

PU 20



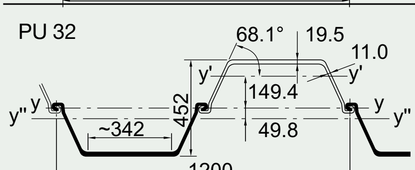
Section	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
Per S	107.4	**84.3 kg/m**	8000	**529**	8.63	0.88
Per D	214.8	**168.6 kg/m**	51600	**2400**	15.50	1.75
Per T	322.2	**252.9 kg/m**	71470	**2770**	14.89	2.62
Per m of wall	179.0	**140.5 kg/m²**	43000	**2000**	15.50	1.46

PU 25



Section	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
Per S	119.2	**93.6 kg/m**	9540	**577**	8.94	0.92
Per D	238.5	**187.2 kg/m**	67790	**3000**	16.86	1.83
Per T	357.8	**280.9 kg/m**	93560	**3420**	16.17	2.74
Per m of wall	199.0	**156.0 kg/m²**	56490	**2500**	16.86	1.52

PU 32



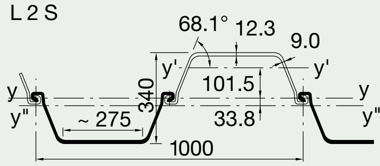
Section	Sectional area cm²	**Mass**	Moment of inertia cm⁴	**Elastic section modulus cm³**	Radius of gyration cm	Coating area* m²/m
Per S	145.4	**114.1 kg/m**	10950	**633**	8.68	0.92
Per D	290.8	**228.3 kg/m**	86790	**3840**	17.28	1.83
Per T	436.2	**342.4 kg/m**	119370	**4330**	16.54	2.74
Per m of wall	242.0	**190.2 kg/m²**	72320	**3200**	17.28	1.52

U SECTIONS

CHARACTERISTICS

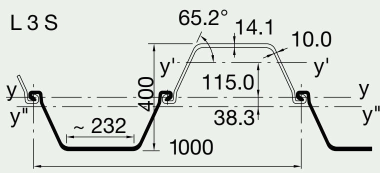
S = Single pile
D = Double pile
T = Triple pile

L 2 S



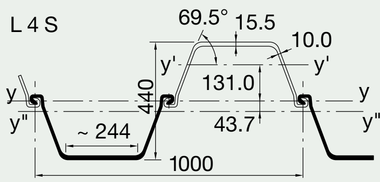
Section		Sectional area (cm²)	**Mass**	Moment of inertia (cm⁴)	**Elastic section modulus (cm³)**	Radius of gyration (cm)	Coating area* (m²/m)
L 2 S	Per S	88.8	**69.7 kg/m**	4440	**359**	7.07	0.74
	Per D	177.6	**139.4 kg/m**	27200	**1600**	12.38	1.46
	Per T	266.4	**209.1 kg/m**	37750	**1850**	11.90	2.20
	Per m of wall	177.0	**139.4 kg/m²**	27200	**1600**	12.38	1.46

L 3 S



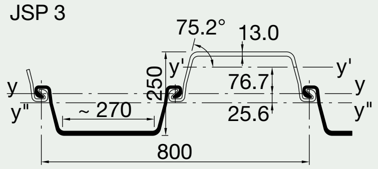
Section		Sectional area (cm²)	**Mass**	Moment of inertia (cm⁴)	**Elastic section modulus (cm³)**	Radius of gyration (cm)	Coating area* (m²/m)
L 3 S	Per S	100.5	**78.9 kg/m**	6710	**485**	8.17	0.77
	Per D	201.0	**157.8 kg/m**	40010	**2000**	14.11	1.52
	Per T	301.5	**236.7 kg/m**	55580	**2330**	13.58	2.29
	Per m of wall	201.0	**157.8 kg/m²**	40010	**2000**	14.11	1.52

L 4 S



Section		Sectional area (cm²)	**Mass**	Moment of inertia (cm⁴)	**Elastic section modulus (cm³)**	Radius of gyration (cm)	Coating area* (m²/m)
L 4 S	Per S	109.8	**86.2 kg/m**	8650	**560**	8.88	0.82
	Per D	219.6	**172.4 kg/m**	55010	**2500**	15.83	1.61
	Per T	329.4	**258.6 kg/m**	76230	**2890**	15.21	2.42
	Per m of wall	219.0	**172.4 kg/m²**	55010	**2500**	15.83	1.61

JSP 3



Section		Sectional area (cm²)	**Mass**	Moment of inertia (cm⁴)	**Elastic section modulus (cm³)**	Radius of gyration (cm)	Coating area* (m²/m)
JSP 3	Per S	76.4	**60.0 kg/m**	2220	**223**	5.39	0.61
	Per D	152.8	**120.0 kg/m**	13440	**1070**	9.38	1.20
	Per T	229.2	**180.0 kg/m**	18660	**1240**	9.02	1.80
	Per m of wall	191.0	**150.0 kg/m²**	16800	**1340**	9.38	1.50

– S: considered neutral axis y'-y'
– D, wall: considered neutral axis y-y
– T: considered neutral axis y"-y"

* One side, excluding inside of interlocks.

DELIVERY FORMS AND INTERLOCKING

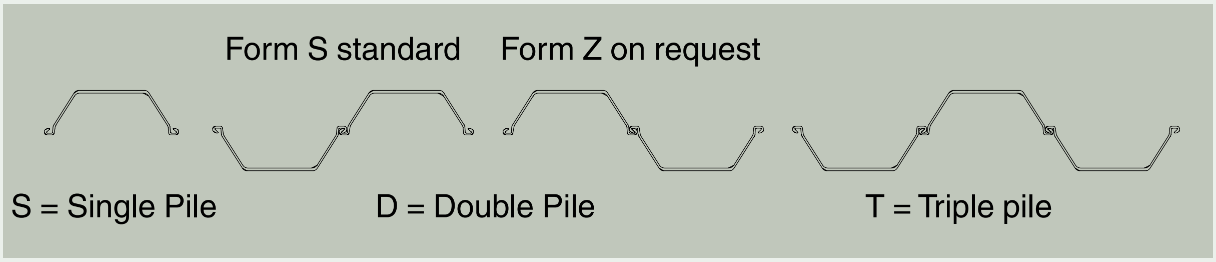
Larssen Interlock

in accordance with EN 10248

Ever since its creation in 1902 this double-grip interlock has proved its efficiency in numerous applications all over the world.

Delivery Forms

Different forms of interlocking may be specified when ordering.

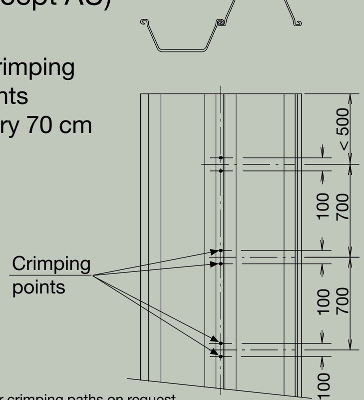


DELIVERY FORMS AND INTERLOCKING

In general, the interlocks of U-sections delivered as double piles are fixed by crimping according to our standard specification. The allowable shear force per crimping point is 75 kN, at a displacement of up to 5 mm. The corresponding ultimate limit force is 100 kN. Depending on the section and steel grade, higher values can be reached. Please consult our Technical Department for further information.

Standard Crimping for U-Sections (except AU)

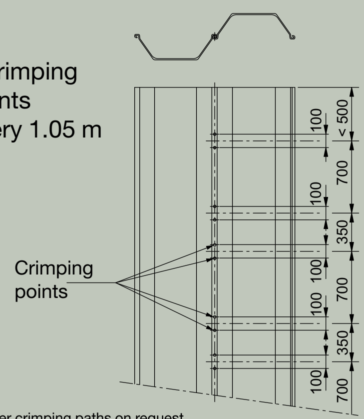
2 crimping points every 70 cm



Smaller crimping paths on request.

Standard Crimping for AU-Sections

4 crimping points every 1.05 m



Smaller crimping paths on request.

Interlocking Possibilities

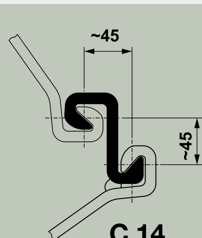
Profil	AU 14	AU 16	AU 17	AU 18	AU 20	AU 21	AU 23	AU 25	AU 26	PU 6	PU 8	PU 12	PU 16	PU 20	PU 25	PU 32	L 2 S	L 3 S	L 4 S	JSP 3
AU 14	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
AU 16	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
AU 17	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
AU 18	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
AU 20	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
AU 21	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
AU 23	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
AU 25	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
AU 26	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
PU 6	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○
PU 8	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○
PU 12	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
PU 16	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
PU 20	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
PU 25	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
PU 32	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
L 2 S	●	●	●	●	●	●	●	●	●	○	○	●	●	●	●	●	●	●	●	●
L 3 S	●	●	●	●	●	●	●	●	●	○	○	●	●	●	●	●	●	●	●	●
L 4 S	●	●	●	●	●	●	●	●	●	○	○	●	●	●	●	●	●	●	●	●
JSP 3	●	●	●	●	●	●	●	●	●	○	○	●	●	●	●	●	●	●	●	●

● = possible ○ = to be checked

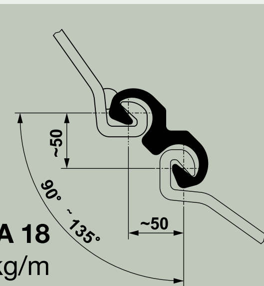
CORNER SECTIONS AND CORNER PILES

Corner Sections

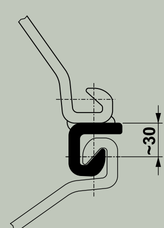
Special corner sections interlocking with every section of the U-series make it possible to form corner or junction piles without resorting to fabricated piles in most cases.



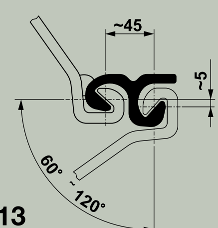
C 14
Mass ~ 14.4 kg/m



OMEGA 18
Mass ~ 18.0 kg/m



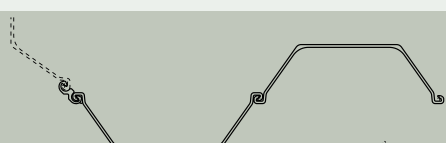
C 9
Mass ~ 9.3 kg/m



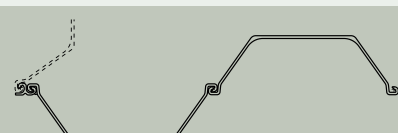
DELTA 13
Mass ~ 13.1 kg/m

The corner sections are fixed to the main sheet pile in accordance with EN 12063.
Different welding specifications on request.
The corner sections are threaded and welded with a 200 mm setback from the top of the piles.

Corner Piles

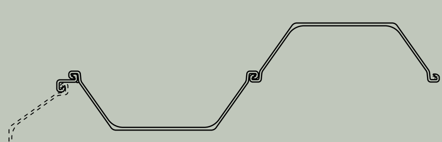


2051

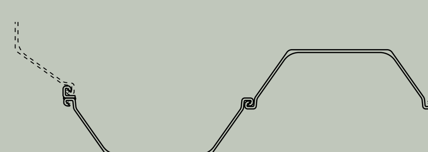


2071

2158



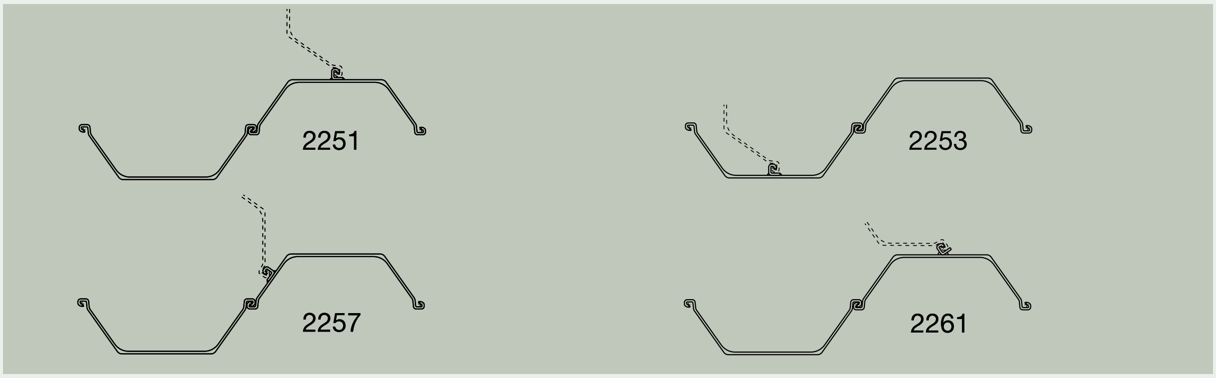
2061



2151

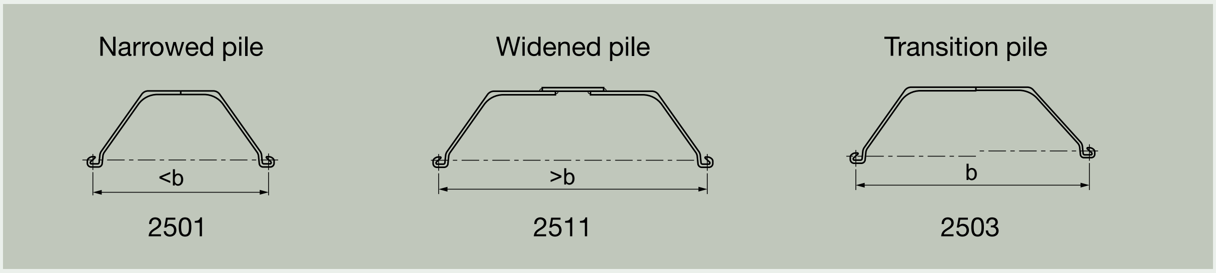
JUNCTION PILES AND FABRICATED PILES

Junction Piles



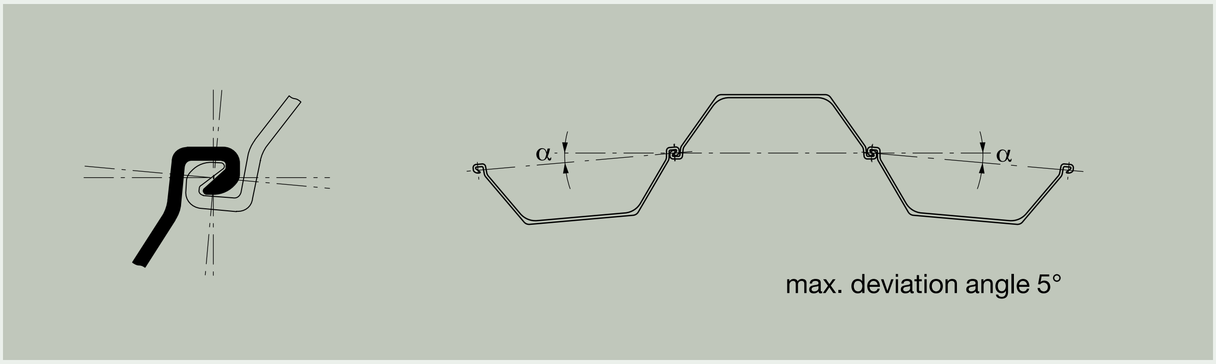
The shown configurations can be supplied as double or single piles. Arrangements with C 14, DELTA 13 and OMEGA 18 are also possible. The corner sections are threaded and welded with a 200 mm setback from the top of the piles.
On request special arrangements can be designed as fabricated piles.

Fabricated Piles

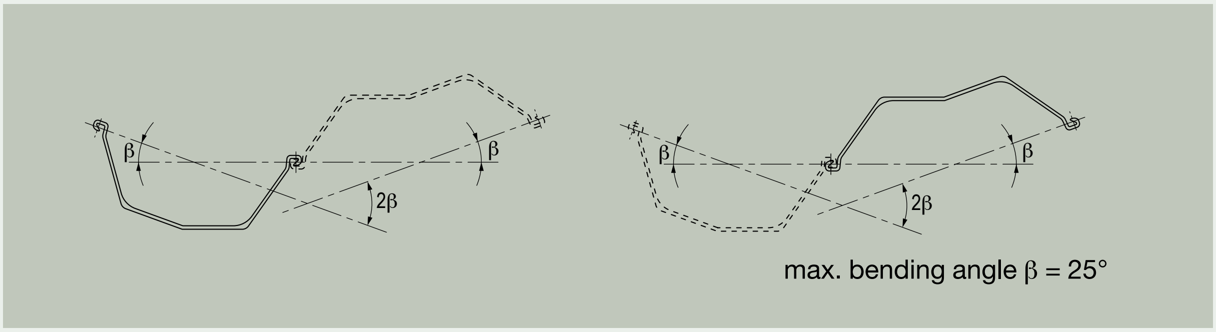


Interlock Swing

Each interlock allows a certain rotation. The maximum angle of deviation (the interlock swing) depends on the pile section and length, the soil conditions, and the installation method.
In general, the maximum deviation of an interlock is 5°.



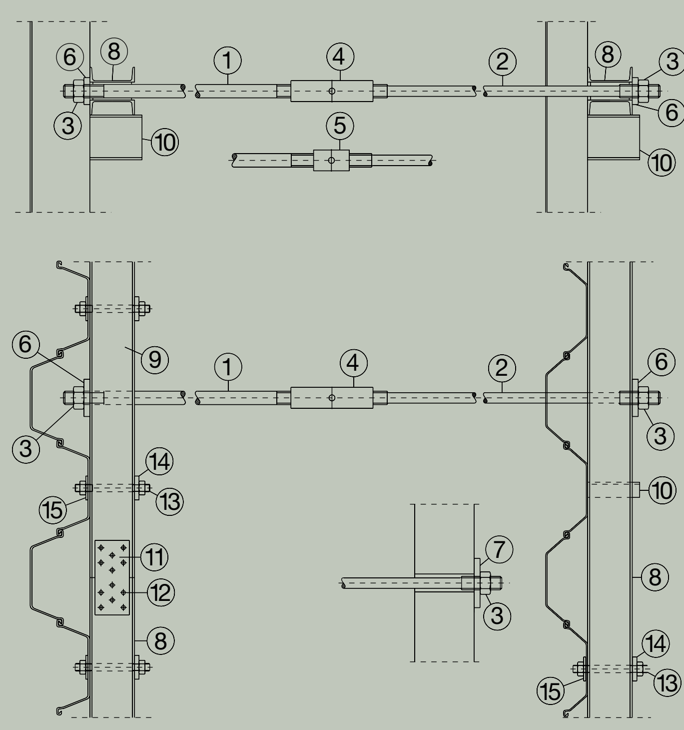
Beyond this value the piles have to be bent.



U piles are bent in the middle of the flange. The maximum bending angle is $\beta = 25°$.
In general, bent piles are delivered as single piles. Double piles upon request.

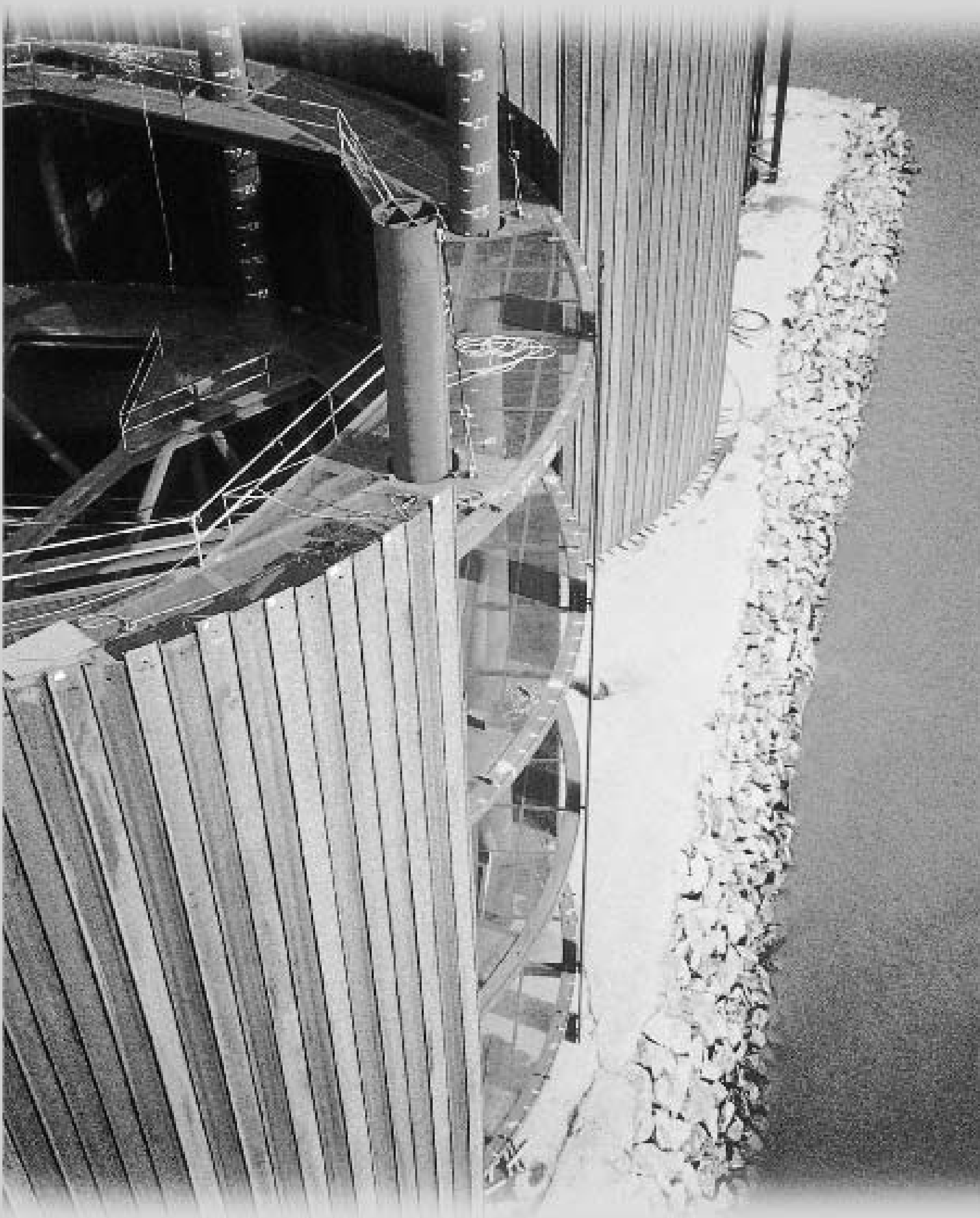
Tie-Back Systems

Most sheet pile retaining walls need supplementary support at the top, in addition to embedment in the soil. Temporary cofferdams generally use walers and struts for cross-bracing inside the excavation. Permanent or large retaining walls are often tied back to an anchor wall installed a certain distance behind the wall.
Injection anchors and anchor piles can also be used.
The following drawing shows a typical horizontal tie-rod connection for U sheet pile walls. The following components can be seen:



1 Plain tie-rod
2 Upset end tie-rod
3 Nut
4 Turnbuckle
5 Coupling sleeve
6 Bearing plate
7 Bearing plate on concrete
8 Waling
9 Spacer
10 Supporting console
11 Splicing plate
12 Splicing bolt
13 Fixing bolt
14 } Fixing plate
15 }

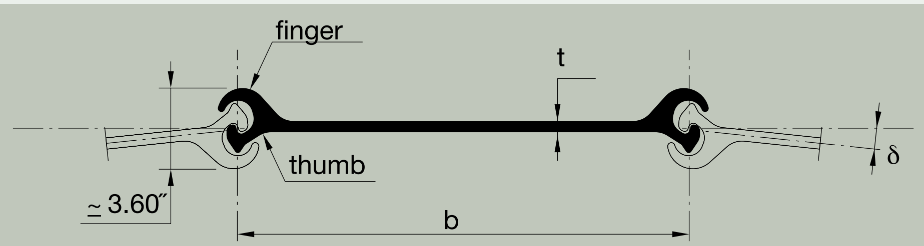
STRAIGHT WEB SECTIONS



STRAIGHT WEB SECTIONS

CHARACTERISTICS

Straight web sheet piles are designed to form cylindrical structures, retaining a soil fill. These cylindrical structures are generally closed.
The stability of constructions built up in this way, a steel envelope and an internal body of soil is guaranteed by their own weight.
Straight web sheet piles are mostly used on projects where rock layers are close to ground level, with deep excavations, or where anchoring would be difficult or even impossible. Straight web sheet pile structures are made as circular cells or diaphragm cells depending on the site characteristics, or the particular requirements of the project.
The forces developing in these sheet pile sections are essentially horizontal traction forces, requiring an interlock resistance corresponding to the horizontal force in the web of the pile.



Section	Nominal width* b (in)	Web thickness t (in)	Deviation angle (δ°)	Perimeter of a single pile (in)	Steel section of a single pile (in²)	Mass per ft of a single pile (lb/ft)	**Mass per ft² of wall (lb/ft²)**	Moment of inertia of a single pile (in⁴)	Section modulus of a single pile (in³)	Coating area*** (ft²/ft)
AS 500-9,5	19.69	0.375	4.5**	54.72	12.65	43.01	**26.22**	4.1	2.3	1.90
AS 500-11,0	19.69	0.433	4.5**	54.72	13.95	47.46	**28.88**	4.5	3.0	1.90
AS 500-12,0	19.69	0.472	4.5**	54.72	14.66	49.93	**30.52**	4.7	3.1	1.90
AS 500-12,5	19.69	0.492	4.5**	54.72	15.07	51.27	**31.34**	4.8	3.1	1.90
AS 500-12,7	19.69	0.500	4.5**	54.72	15.22	51.81	**31.54**	4.9	3.1	1.90

Note: all straight web sections interlock with each other.
* The **effective width** to be taken into account for design purposes (lay-out) is **19.80 in** for all AS 500 sheet piles.
** Max. deviation angle 4.0° for pile length > 65.6 ft.
*** One side, excluding inside of interlocks.

Interlock Strength

The interlock complies with EN 10248. An interlock strength of 5,000 kN/m (28540 lb/in) for AS 500-12.0 and 5,500 kN/m for AS 500-12.5 and AS 500-12.7 can be obtained (the test procedure used to determinate the interlock strength is that of section B.3 of ENV 1993-5). The required steel grade in these cases is S 355 GP (Grade 50).

For verification of the strength of piles, both yielding of the web and failure of the interlock should be considered. The allowable tension force in the pile may be obtained by applying a set of carefully chosen safety factors, for example: $\eta_i = 2.0$ for the interlock resistance and $\eta_y = 1.5$ for yielding of the web.

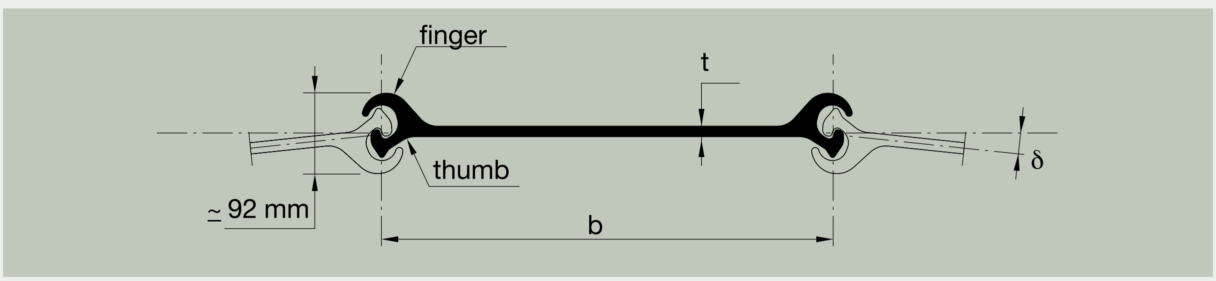
The magnitude of safety factors depends on the calculation method and assumptions, the installation method and the function of the structure. When two different sections are used in the same section of wall, the lowest allowable tension force is to be taken into account.

STRAIGHT WEB SECTIONS

STRAIGHT WEB SECTIONS

CHARACTERISTICS

Straight web sheet piles are designed to form cylindrical structures, retaining a soil fill. These cylindrical structures are generally closed.
The stability of constructions built up in this way, a steel envelope and an internal body of soil is guaranteed by their own weight.
Straight web sheet piles are mostly used on projects where rock layers are close to ground level, where the excavation depth is very great, or where anchoring would be difficult or even impossible. Straight web sheet pile structures are made as circular cells or diaphragm cells depending on the site characteristics, or the particular requirements of the project.
The forces developing in these sheet pile sections are essentially horizontal traction forces, requiring an interlock resistance corresponding to the horizontal force in the web of the pile.



Section	Nominal width*	Web thickness	Deviation angle	Perimeter of a single pile	Steel section of a single pile	Mass per m of a single pile	**Mass per m² of wall**	Moment of inertia of a single pile	Section modulus of a single pile	Coating area***
	b mm	t mm	δ°	cm	cm²	kg/m	**kg/m²**	cm⁴	cm³	m²/m
AS 500-9,5	500	9.5	4.5**	139	81.6	64.0	**128**	170	37	0.58
AS 500-11,0	500	11.0	4.5**	139	90.0	70.6	**141**	186	49	0.58
AS 500-12,0	500	12.0	4.5**	139	94.6	74.3	**149**	196	51	0.58
AS 500-12,5	500	12.5	4.5**	139	97.2	76.3	**153**	201	51	0.58
AS 500-12,7	500	12.7	4.5**	139	98.2	77.1	**154**	204	52	0.58

Note: all straight web sections interlock with each other.
* The **effective width** to be taken into account for design purposes (lay-out) is **503 mm** for all AS 500 sheet piles.
** Max. deviation angle 4.0° for pile length > 20 m.
*** One side, excluding inside of interlocks.

Interlock Strength

The interlock complies with EN 10248. An interlock strength of 5.500 kN/m for AS 500-12.5 and AS 500-12.7, 5.000 kN/m for AS 500-12.0, 3.500 kN/m for AS 500-11.0 and 3.000 kN/m for AS 500-9.5 can be obtained (the test procedure used to determinate the interlock strength is that of section B.3 of ENV 1993-5). The required steel grade in these cases is S 355 GP.

For verification of the strength of piles, both yielding of the web and failure of the interlock should be considered. The allowable tension force in the pile may be obtained by applying a set of carefully chosen safety factors, for example: η_i = 2.0 for the interlock resistance and η_y = 1.5 for yielding of the web.

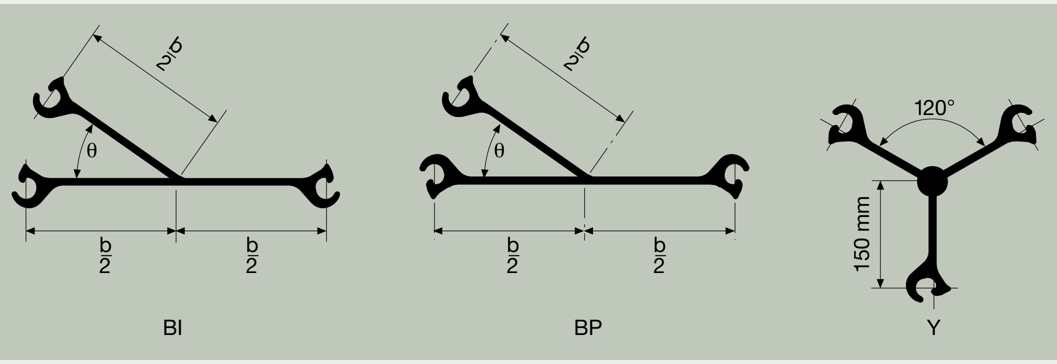
The magnitude of safety factors depends on the calculation method and assumptions, the installation method and the function of the structure. When two different sections are used in the same section of wall, the lowest allowable tension force is to be taken into account.

STRAIGHT WEB SECTIONS

GEOMETRICAL CHARACTERISTICS

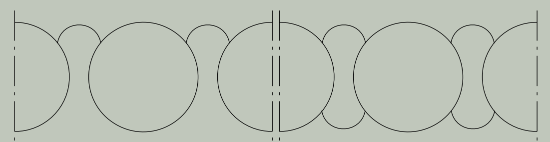
Junction Piles

In general junction piles are assembled by welding in accordance with EN 12063.



The connecting angle θ should be in the range from 30° to 45°.

Types of Cells

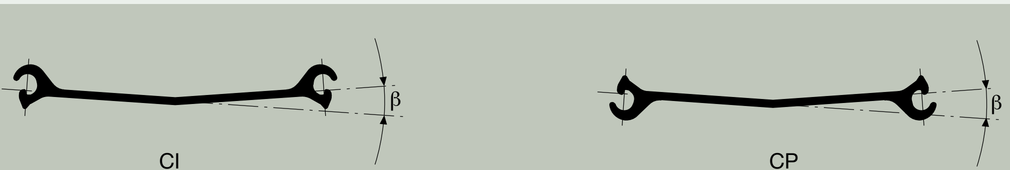


Circular cells with 35° junction piles and one or two connecting arcs.

Diaphragm cells with 120° junction piles.

Bent Piles

If deviation angles exceeding the values given in the table on page 29 have to be attained, piles pre-bent in the mill may be used.



STRAIGHT WEB SECTIONS

GEOMETRICAL CHARACTERISTICS

Equivalent Width and Ratio

The ***equivalent width w*****ₑ** which is required for stability verification, determines the geometry of the chosen cellular construction.

- **for circular cells**

The equivalent width is defined as:

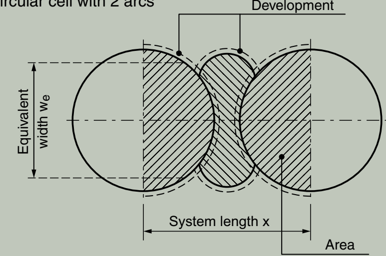
$$w_e = \frac{\textit{Area within 1 cell + Area within 2 (or 1) arc(s)}}{\textit{System length x}}$$

The ***ratio*** shown on tables indicates how economical the chosen circular cell will be.

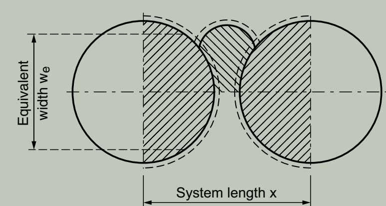
It is defined as follows:

$$\text{Ratio} = \frac{\textit{Development 1 cell + Development 2 (or 1) arc(s)}}{\textit{System length x}}$$

Circular cell with 2 arcs

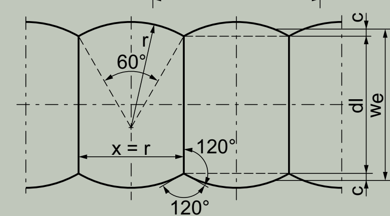


Circular cell with 1 arc

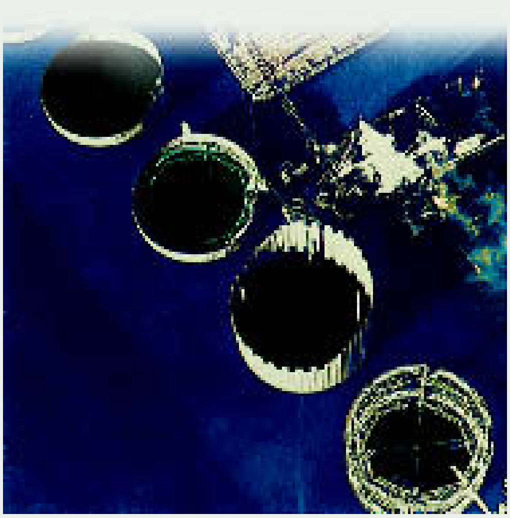


- **for diaphragm cells**

The ***equivalent width*** w_e is defined as:
w_e = diaphragm wall length (dl) + 2 · c



Circular Cell Construction



3rd phase: Driving

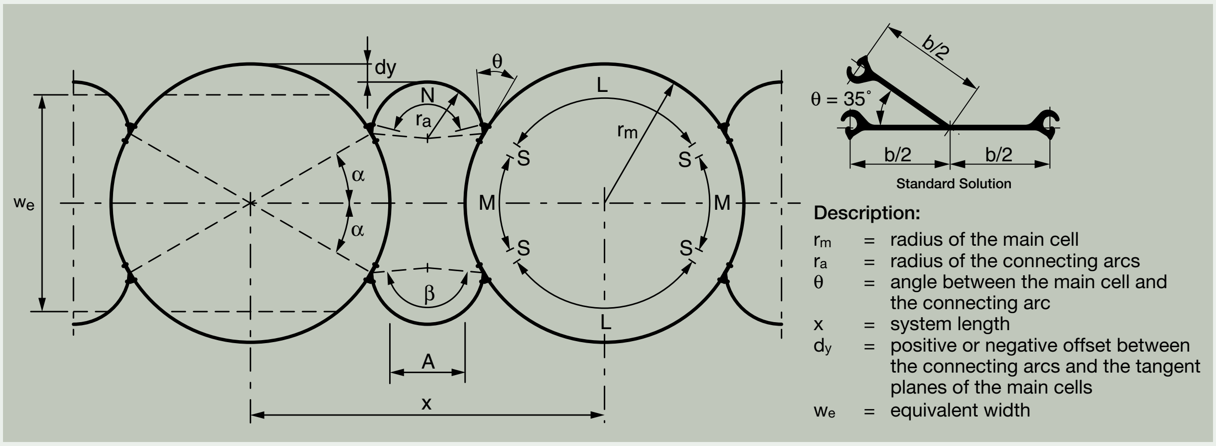
2nd phase: Threading of piling until cell closure

1st phase: Installation of the template

STRAIGHT WEB SECTIONS

CIRCULAR CELLS

Once the equivalent width has been determined, the geometry of the cells is to be defined. This can be done with the help of tables or with computer programs. Several solutions are possible for both circular and diaphragm cells with a given equivalent width.

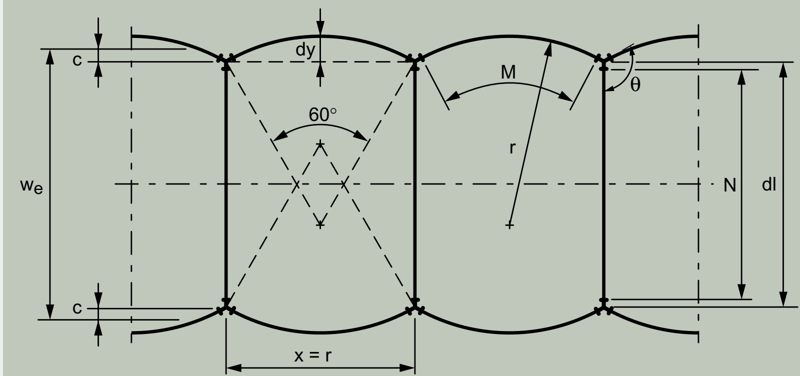


Junction piles with angles θ between 30° and 45°, as well as θ = 90°, are possible on request. The following table shows a short selection of solutions for **circular cells with 2 arcs** and standard junction piles with θ = 35°.

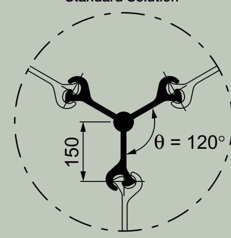
Nb. of piles per						Geometrical values								Design values	
												Interlock deviation			
Cell				Arc	System							cell	arc	**2 arcs**	2 arcs
	L	M	S	N		$d=2 \cdot r_m$	r_a	x	d_y	α	β	δ_m	δ_a	$\mathbf{w_e}$	ratio
pcs.	pcs.	pcs.	pcs.	pcs.	pcs.	ft	ft	ft	in	°	°	°	°	**ft**	
100	33	15	4	25	150	52.53	14.67	75.20	6.30	28.80	167.60	3.60	6.45	**44.91**	3.34
104	35	15	4	27	158	54.63	16.01	80.12	7.87	27.69	165.38	3.46	5.91	**46.40**	3.30
108	37	15	4	27	162	56.73	16.21	82.78	21.26	26.67	163.33	3.33	5.83	**47.29**	3.27
112	37	17	4	27	166	58.83	15.78	82.84	12.99	28.93	167.86	3.21	6.00	**50.05**	3.35
116	37	19	4	27	170	60.93	15.39	82.91	5.12	31.03	172.07	3.10	6.15	**52.75**	3.42
120	39	19	4	29	178	63.03	16.67	87.83	6.30	30.00	170.00	3.00	5.67	**54.26**	3.38
124	41	19	4	29	182	65.12	16.86	90.52	19.69	29.03	168.06	2.90	5.60	**55.18**	3.35
128	43	19	4	31	190	67.22	18.21	95.44	20.87	28.13	166.25	2.81	5.20	**56.67**	3.32
132	43	21	4	31	194	69.32	17.78	95.51	12.99	30.00	170.00	2.73	5.31	**59.39**	3.39
136	45	21	4	33	202	71.42	19.09	100.43	14.17	29.12	168.24	2.65	4.95	**60.89**	3.35
140	45	23	4	33	206	73.56	18.73	100.46	6.69	30.86	171.71	2.57	5.05	**63.61**	3.42
144	47	23	4	33	210	75.66	18.90	103.18	19.69	30.00	170.00	2.50	5.00	**64.53**	3.39
148	47	25	4	35	218	77.76	19.65	105.41	0.00	31.62	173.24	2.43	4.81	**67.82**	3.44
152	49	25	4	35	222	79.86	19.85	108.17	13.39	30.79	171.58	2.37	4.77	**68.72**	3.42
156	49	27	4	35	226	81.96	19.49	108.20	5.91	32.31	174.62	2.31	4.85	**71.39**	3.48
160	51	27	4	37	234	84.06	20.77	113.12	6.69	31.50	173.00	2.25	4.55	**72.93**	3.44
164	53	27	4	39	242	86.16	22.05	118.04	7.87	30.73	171.46	2.20	4.29	**74.45**	3.41
168	55	27	4	41	250	88.25	23.36	122.97	9.06	30.00	170.00	2.14	4.05	**75.97**	3.38
172	55	29	4	41	254	90.35	22.97	123.00	1.18	31.40	172.79	2.09	4.11	**78.66**	3.43
176	57	29	4	41	258	92.45	23.16	125.72	14.57	30.68	171.36	2.05	4.08	**79.58**	3.41
180	59	29	4	43	266	94.55	24.48	130.64	15.75	30.00	170.00	2.00	3.86	**81.09**	3.39
184	59	31	4	43	270	96.65	24.11	130.68	7.87	31.30	172.61	1.96	3.92	**83.79**	3.43
188	61	31	4	45	278	98.75	25.39	135.60	9.06	30.64	171.28	1.91	3.72	**85.31**	3.41

STRAIGHT WEB SECTIONS

DIAPHRAGM CELLS



Standard Solution



Description:

- r = radius
- θ = angle between the arc and the diaphragm
- w_e = equivalent width, with $w_e = dl + 2 \cdot c$
- dy = arc height
- dl = diaphragm wall length
- x = system length

The two following tables should be used separately depending on the required number of piles for the diaphragm wall and the arcs.

Geometry diaphragm wall

Number of piles	Diaphragm wall length
N	dl
pcs.	ft
11	19.13
13	22.44
15	25.75
17	29.04
19	32.35
21	35.63
23	38.94
25	42.26
27	45.54
29	48.85
31	52.13
33	55.45
35	58.76
37	62.04
39	65.35
41	68.64
43	71.95
45	75.26
47	78.54
49	81.86
51	85.14
53	88.45
55	91.77

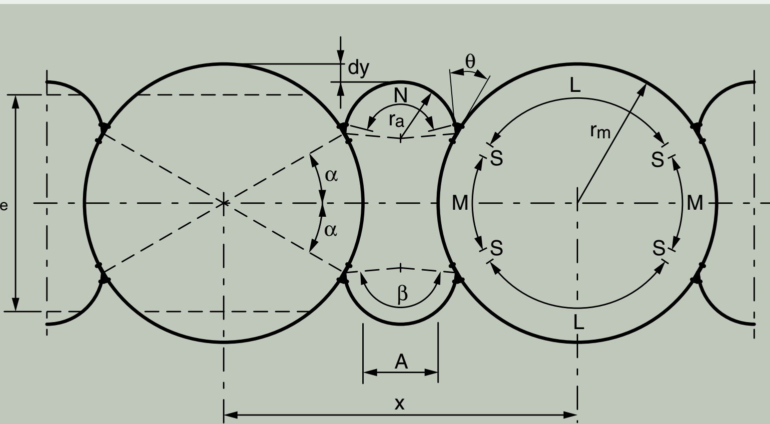
Geometry arc

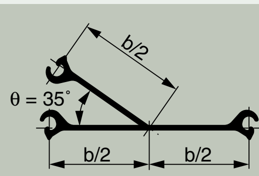
Number of piles	System length	Arc height		Interlock deviation arc
M	x	d_y	c	δa
pcs.	ft	ft	ft	°
11	18.27	2.46	1.66	5.17
13	21.42	2.85	1.94	4.41
15	24.57	3.28	2.23	3.85
17	27.72	3.71	2.53	3.41
19	30.87	4.13	2.82	3.06
21	34.02	4.56	3.08	2.78
23	37.17	4.99	3.36	2.54
25	40.32	5.41	3.66	2.34
27	43.50	5.84	3.94	2.17
29	46.65	6.23	4.23	2.03
31	49.80	6.66	4.51	1.90
33	52.95	7.09	4.79	1.79
35	56.10	7.51	5.09	1.69
37	59.25	7.94	5.38	1.60
39	62.40	8.37	5.68	1.52
41	65.55	8.79	5.94	1.44
43	68.70	9.22	6.23	1.38
45	71.85	9.61	6.53	1.32
47	75.00	10.04	6.79	1.26
49	78.15	10.47	7.09	1.21
51	81.30	10.89	7.38	1.16
53	84.45	11.32	7.64	1.12
55	87.60	11.75	7.94	1.08

STRAIGHT WEB SECTIONS

CIRCULAR CELLS

Once the equivalent width has been determined, the geometry of the cells is to be defined. This can be done with the help of tables or with computer programs. Several solutions are possible for both circular and diaphragm cells with a given equivalent width.





Standard Solution

Description:

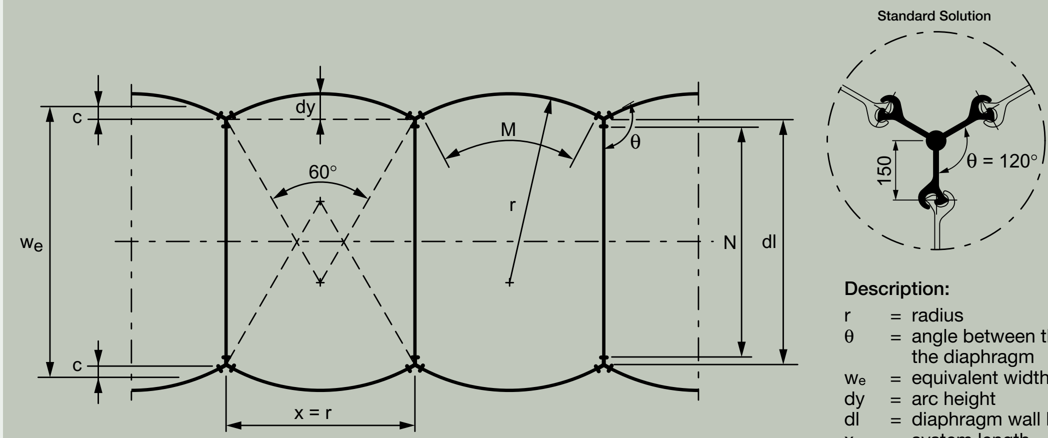
- r_m = radius of the main cell
- r_a = radius of the connecting arcs
- θ = angle between the main cell and the connecting arc
- x = system length
- d_y = positive or negative offset between the connecting arcs and the tangent planes of the main cells
- w_e = equivalent width

Junction piles with angles θ between 30° and 45°, as well as θ = 90°, are possible on request. The following table shows a short selection of solutions for **circular cells with 2 arcs** and standard junction piles with θ = 35°.

Nb. of piles per						**Geometrical values**								**Design values**	
												Interlock deviation			
Cell				Arc	System							cell	arc	**2 arcs**	2 arcs
	L	M	S	N		$d=2\cdot r_m$	r_a	x	d_y	α	β	δ_m	δ_a	$\mathbf{w_e}$	ratio
pcs.	pcs.	pcs.	pcs.	pcs.	pcs.	m	m	m	m	°	°	°	°	**m**	
100	33	15	4	25	150	16.01	4.47	22.92	0.16	28.80	167.60	3.60	6.45	**13.69**	3.34
104	35	15	4	27	158	16.65	4.88	24.42	0.20	27.69	165.38	3.46	5.91	**14.14**	3.30
108	37	15	4	27	162	17.29	4.94	25.23	0.54	26.67	163.33	3.33	5.83	**14.41**	3.27
112	37	17	4	27	166	17.93	4.81	25.25	0.33	28.93	167.86	3.21	6.00	**15.25**	3.35
116	37	19	4	27	170	18.57	4.69	25.27	0.13	31.03	172.07	3.10	6.15	**16.08**	3.42
120	39	19	4	29	178	19.21	5.08	26.77	0.16	30.00	170.00	3.00	5.67	**16.54**	3.38
124	41	19	4	29	182	19.85	5.14	27.59	0.50	29.03	168.06	2.90	5.60	**16.82**	3.35
128	43	19	4	31	190	20.49	5.55	29.09	0.53	28.13	166.25	2.81	5.20	**17.27**	3.32
132	43	21	4	31	194	21.13	5.42	29.11	0.33	30.00	170.00	2.73	5.31	**18.10**	3.39
136	45	21	4	33	202	21.77	5.82	30.61	0.36	29.12	168.24	2.65	4.95	**18.56**	3.35
140	45	23	4	33	206	22.42	5.71	30.62	0.17	30.86	171.71	2.57	5.05	**19.39**	3.42
144	47	23	4	33	210	23.06	5.76	31.45	0.50	30.00	170.00	2.50	5.00	**19.67**	3.39
148	47	25	4	35	218	23.70	5.99	32.13	0.00	31.62	173.24	2.43	4.81	**20.67**	3.44
152	49	25	4	35	222	24.34	6.05	32.97	0.34	30.79	171.58	2.37	4.77	**20.95**	3.42
156	49	27	4	35	226	24.98	5.94	32.98	0.15	32.31	174.62	2.31	4.85	**21.76**	3.48
160	51	27	4	37	234	25.62	6.33	34.48	0.17	31.50	173.00	2.25	4.55	**22.23**	3.44
164	53	27	4	39	242	26.26	6.72	35.98	0.20	30.73	171.46	2.20	4.29	**22.69**	3.41
168	55	27	4	41	250	26.90	7.12	37.48	0.23	30.00	170.00	2.14	4.05	**23.15**	3.38
172	55	29	4	41	254	27.54	7.00	37.49	0.03	31.40	172.79	2.09	4.11	**23.98**	3.43
176	57	29	4	41	258	28.18	7.06	38.32	0.37	30.68	171.36	2.05	4.08	**24.26**	3.41
180	59	29	4	43	266	28.82	7.46	39.82	0.40	30.00	170.00	2.00	3.86	**24.72**	3.39
184	59	31	4	43	270	29.46	7.35	39.83	0.20	31.30	172.61	1.96	3.92	**25.54**	3.43
188	61	31	4	45	278	30.10	7.74	41.33	0.23	30.64	171.28	1.91	3.72	**26.00**	3.41

STRAIGHT WEB SECTIONS

DIAPHRAGM CELLS



Description:

- r = radius
- θ = angle between the arc and the diaphragm
- w_e = equivalent width, with $w_e = dl + 2 \cdot c$
- dy = arc height
- dl = diaphragm wall length
- x = system length

The two following tables should be used separately depending on the required number of piles for the diaphragm wall and the arcs.

Geometry diaphragm wall

Number of piles N pcs.	Diaphragm wall length dl m
11	5.83
13	6.84
15	7.85
17	8.85
19	9.86
21	10.86
23	11.87
25	12.88
27	13.88
29	14.89
31	15.89
33	16.90
35	17.91
37	18.91
39	19.92
41	20.92
43	21.93
45	22.94
47	23.94
49	24.95
51	25.95
53	26.96
55	27.97

Geometry arc

Number of piles M pcs.	System length x m	Arc height d_y m	c m	Interlock deviation arc δa °
11	5.57	0.75	0.51	5.17
13	6.53	0.87	0.59	4.41
15	7.49	1.00	0.68	3.85
17	8.45	1.13	0.77	3.41
19	9.41	1.26	0.86	3.06
21	10.37	1.39	0.94	2.78
23	11.33	1.52	1.03	2.54
25	12.29	1.65	1.12	2.34
27	13.26	1.78	1.20	2.17
29	14.22	1.90	1.29	2.03
31	15.18	2.03	1.38	1.90
33	16.14	2.16	1.46	1.79
35	17.10	2.29	1.55	1.69
37	18.06	2.42	1.64	1.60
39	19.02	2.55	1.73	1.52
41	19.98	2.68	1.81	1.44
43	20.94	2.81	1.90	1.38
45	21.90	2.93	1.99	1.32
47	22.86	3.06	2.07	1.26
49	23.82	3.19	2.16	1.21
51	24.78	3.32	2.25	1.16
53	25.74	3.45	2.33	1.12
55	26.70	3.58	2.42	1.08

BOX PILES

Sheet piles can easily be built together to form box piles with a wide range of characteristics. These box piles present all the typical advantages of steel bearing piles.

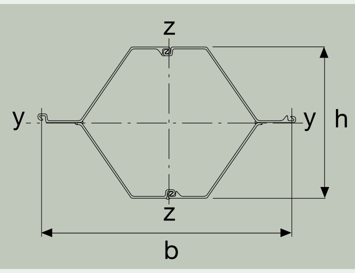
Integrated in a sheet pile wall they provide supplementary bending resistance and may take high vertical loads.

They are an excellent construction element for dolphins.

BOX PILES

CHARACTERISTICS

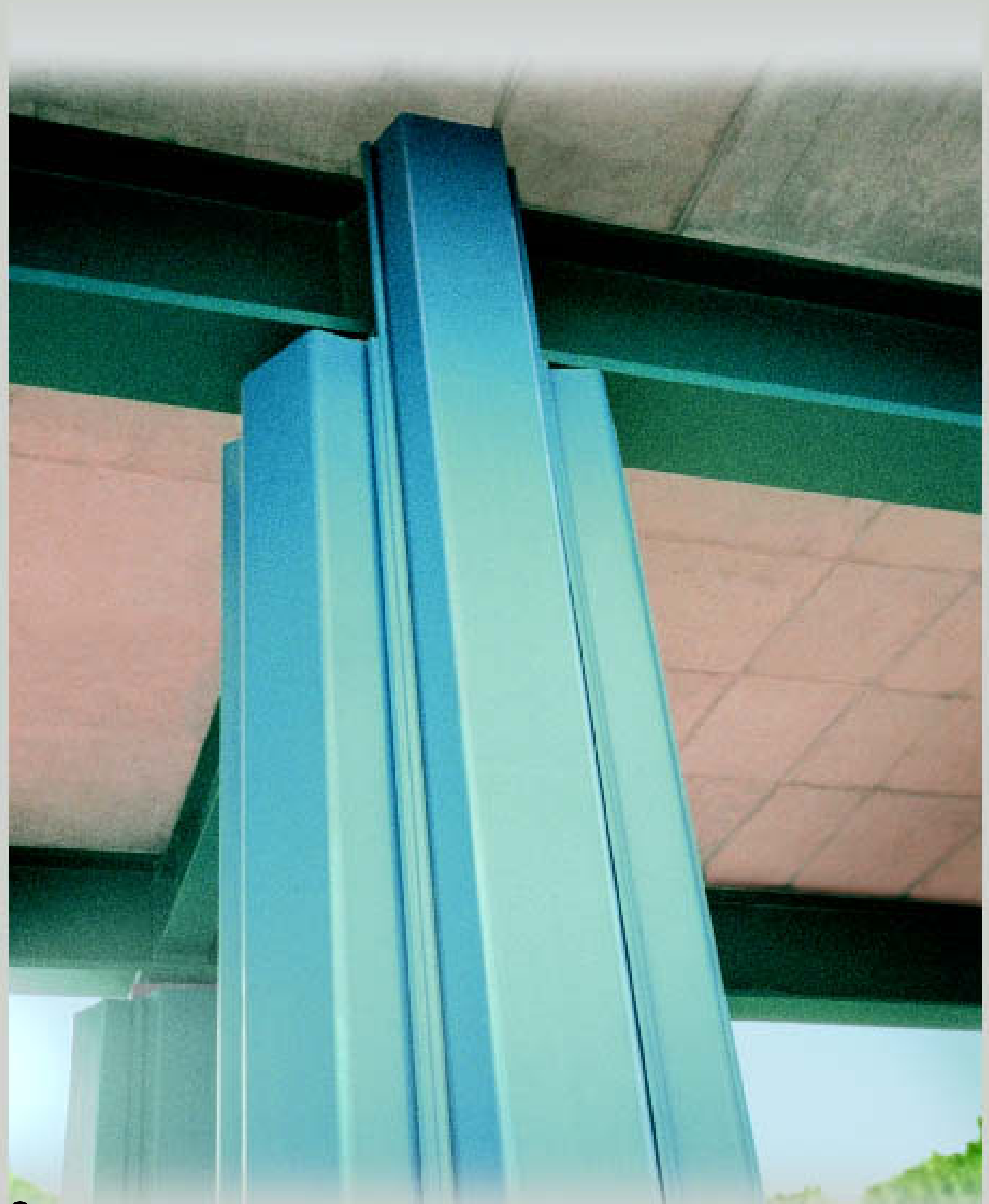
AZ Box Piles



Section	b	h	Perimeter	Steel section	Total section	**Mass***	Moment of inertia		**Elastic section modulus**		Min. radius of gyration	Coating area**
							y-y	z-z	**y-y**	**z-z**		
	in	in	in	in²	in²	**lb/ft**	in⁴	in⁴	**in³**	**in³**	in	ft²/ft
CAZ 12	52.76	23.78	137.0	45.4	645.7	**154.69**	3017.8	8877.5	**252.3**	**323.1**	8.15	10.79
CAZ 13	52.76	23.86	137.4	49.6	649.6	**168.87**	3287.8	9664.5	**274.0**	**351.8**	8.15	10.79
CAZ 14	52.76	23.94	137.4	53.9	653.6	**183.65**	3574.2	10481.1	**296.9**	**381.7**	8.15	10.79
CAZ 17	49.61	29.84	141.7	47.3	759.5	**160.80**	4926.1	8069.5	**328.6**	**311.5**	10.20	11.19
CAZ 18	49.61	29.92	142.1	51.6	763.4	**175.38**	5355.9	8781.1	**356.4**	**339.3**	10.20	11.19
CAZ 19	49.61	30.00	142.1	56.1	767.4	**190.77**	5819.1	9528.3	**386.3**	**368.3**	10.20	11.19
CAZ 25	49.61	33.54	148.0	63.7	858.7	**217.05**	8240.6	10817.0	**489.4**	**422.6**	11.38	11.71
CAZ 26	49.61	33.62	148.4	68.2	862.7	**232.30**	8812.9	11541.9	**522.1**	**450.7**	11.38	11.71
CAZ 28	49.61	33.70	148.4	73.0	866.8	**248.49**	9421.9	12326.0	**556.8**	**477.2**	11.38	11.71
CAZ 34	49.61	36.14	154.3	80.0	929.9	**272.08**	12202.1	13275.5	**672.5**	**519.9**	12.36	12.24
CAZ 36	49.61	36.22	154.7	84.8	934.0	**288.61**	12922.1	14059.4	**710.6**	**551.0**	12.36	12.24
CAZ 38	49.61	36.30	154.7	89.7	938.2	**305.48**	13666.4	14865.9	**750.0**	**582.8**	12.36	12.24
CAZ 46	45.67	37.87	157.9	92.2	903.8	**314.01**	15518.7	12675.3	**816.5**	**538.5**	12.95	12.50
CAZ 48	45.67	37.95	158.3	97.3	908.0	**331.28**	16365.6	13359.6	**859.2**	**567.5**	12.95	12.50
CAZ 50	45.67	38.03	158.3	102.5	912.0	**348.62**	17216.8	14044.1	**901.9**	**596.8**	12.95	12.50

* The mass of the welds is not taken into account.
** Outside surface, excluding inside of interlocks.

BOX PILES



Sheet piles can easily be built together to form box piles with a wide range of characteristics. These box piles present all the typical advantages of steel bearing piles.
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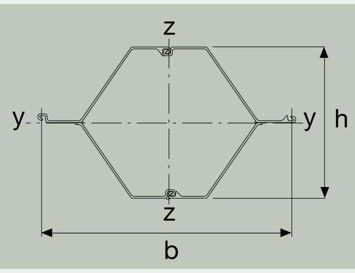
BOX PILES

CHARACTERISTICS

AZ Box Piles



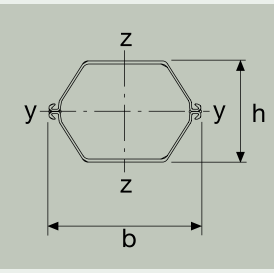
Section	b	h	Perimeter	Steel section	Total section	**Mass***	Moment of inertia		**Elastic section modulus**		Min. radius of gyration	Coating area**
							y-y	z-z	**y-y**	**z-z**		
	mm	mm	cm	cm^2	cm^2	**kg/m**	cm^4	cm^4	**cm^3**	**cm^3**	cm	m^2/m
CAZ 12	1340	604	348	293	4166	**230**	125610	369510	**4135**	**5295**	20.7	3.29
CAZ 13	1340	606	349	320	4191	**251**	136850	402270	**4490**	**5765**	20.7	3.29
CAZ 14	1340	608	349	348	4217	**273**	148770	436260	**4865**	**6255**	20.7	3.29
CAZ 17	1260	758	360	305	4900	**239**	205040	335880	**5385**	**5105**	25.9	3.41
CAZ 18	1260	760	361	333	4925	**261**	222930	365500	**5840**	**5560**	25.9	3.41
CAZ 19	1260	762	361	362	4951	**284**	242210	396600	**6330**	**6035**	25.9	3.41
CAZ 25	1260	852	376	411	5540	**323**	343000	450240	**8020**	**6925**	28.9	3.57
CAZ 26	1260	854	377	440	5566	**346**	366820	480410	**8555**	**7385**	28.9	3.57
CAZ 28	1260	856	377	471	5592	**370**	392170	513050	**9125**	**7820**	28.9	3.57
CAZ 34	1260	918	392	516	5999	**405**	507890	552570	**11020**	**8520**	31.4	3.73
CAZ 36	1260	920	393	547	6026	**430**	537860	585200	**11645**	**9030**	31.4	3.73
CAZ 38	1260	922	393	579	6053	**455**	568840	618770	**12290**	**9550**	31.4	3.73
CAZ 46	1160	962	401	595	5831	**467**	645940	527590	**13380**	**8825**	32.9	3.81
CAZ 48	1160	964	402	628	5858	**493**	681190	556070	**14080**	**9300**	32.9	3.81
CAZ 50	1160	966	402	661	5884	**519**	716620	584560	**14780**	**9780**	32.9	3.81

* The mass of the welds is not taken into account.
** Outside surface, excluding inside of interlocks.

BOX PILES

CHARACTERISTICS

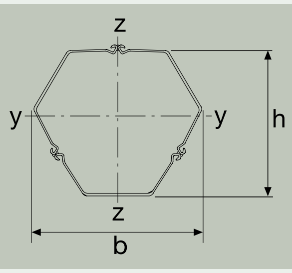
U-Box Piles



Section	b	h	Perimeter	Steel section	Total section	**Mass***	Moment of inertia		**Elastic section modulus**		Min. radius of gyration	Coating area**
							y-y	z-z	**y-y**	**z-z**		
	mm	mm	cm	cm^2	cm^2	**kg/m**	cm^4	cm^4	**cm^3**	**cm^3**	cm	m^2/m
CAU 14-2	785	449	230	199	2584	**155.8**	53850	121300	**2400**	**3095**	16.5	2.04
CAU 16-2	785	454	231	220	2620	**172.5**	62240	130380	**2745**	**3325**	16.8	2.04
CAU 17-2	785	455	231	227	2626	**178.1**	64840	133330	**2855**	**3400**	16.9	2.04
CAU 18-2	786	486	239	225	2888	**177.0**	73770	142380	**3035**	**3625**	18.1	2.14
CAU 20-2	786	489	240	247	2910	**193.8**	83370	151220	**3405**	**3850**	18.4	2.14
CAU 21-2	786	490	240	254	2916	**199.3**	86540	153990	**3530**	**3920**	18.5	2.14
CAU 23-2	786	492	244	260	3013	**204.2**	94540	157900	**3845**	**4020**	19.1	2.19
CAU 25-2	786	495	245	281	3034	**220.8**	104810	166600	**4235**	**4240**	19.3	2.19
CAU 26-2	786	496	245	288	3041	**226.4**	108260	169510	**4365**	**4315**	19.4	2.19
CU 6-2	632	264	180	116	1315	**91.2**	11600	48300	**875**	**1530**	10.0	1.55
CU 8-2	633	321	189	139	1569	**109.1**	19200	60000	**1195**	**1895**	11.8	1.63
CU 12-2	635	403	198	168	1850	**132.2**	34000	70000	**1685**	**2205**	14.2	1.72
CU 12 10/10-2	635	403	198	177	1850	**139.2**	35580	73460	**1765**	**2315**	14.2	1.72
CU 16-2	635	423	204	190	2020	**149.4**	46800	75900	**2215**	**2395**	15.7	1.78
CU 20-2	636	475	214	215	2280	**168.6**	65100	88500	**2740**	**2785**	17.4	1.89
CU 25-2	636	497	222	239	2450	**187.2**	84300	97000	**3395**	**3050**	18.8	1.97
CU 32-2	636	499	223	291	2461	**228.3**	108800	109200	**4360**	**3435**	19.3	1.97
LP 2 S	536	385	189	178	1583	**139.4**	36100	52300	**1880**	**1950**	14.3	1.61
LP 3 S	537	447	195	201	1748	**157.8**	51800	57100	**2320**	**2130**	16.1	1.67
LP 4 S	537	487	204	220	1927	**172.4**	69600	61800	**2860**	**2300**	17.8	1.76

* The mass of the welds is not taken into account.
** Outside surface, excluding inside of interlocks.

U-Box Piles



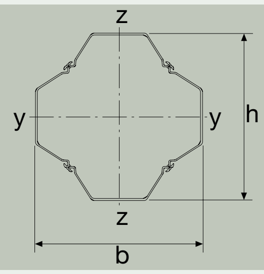
Section	b	h	Perimeter	Steel section	Total section	**Mass***	Moment of inertia		**Elastic section modulus**		Min. radius of gyration	Coating area**
							y-y	z-z	**y-y**	**z-z**		
	mm	mm	cm	cm²	cm²	**kg/m**	cm⁴	cm⁴	**cm³**	**cm³**	cm	m²/m
CAU 14-3	955	907	341	298	6432	**233.7**	299200		**6490**	**6265**	31.7	3.03
CAU 16-3	960	910	342	330	6486	**258.7**	333640		**7235**	**6955**	31.8	3.03
CAU 17-3	960	910	343	340	6496	**267.2**	344760		**7675**	**7180**	31.8	3.03
CAU 18-3	1009	927	355	338	6886	**265.5**	363690		**7825**	**7205**	32.8	3.17
CAU 20-3	1012	928	356	370	6919	**290.7**	399780		**8570**	**7900**	32.9	3.17
CAU 21-3	1013	929	359	381	6926	**299.0**	411460		**8810**	**8125**	32.9	3.17
CAU 23-3	1036	930	361	390	7073	**306.3**	431940		**9235**	**8340**	33.3	3.24
CAU 25-3	1038	931	364	422	7106	**331.3**	469030		**9995**	**9035**	33.3	3.24
CAU 26-3	1039	932	364	433	7115	**339.6**	481240		**10245**	**9260**	33.3	3.24
CU 6-3	715	682	267	174	3625	**136.8**	99900		**2685**	**2795**	23.9	2.29
CU 8-3	757	711	279	208	3999	**163.6**	130100		**3480**	**3435**	25.0	2.41
CU 12-3	800	755	293	253	4431	**198.3**	173100		**4555**	**4325**	26.2	2.54
CU 12 10/10-3	800	755	293	266	4432	**208.8**	182100		**4790**	**4555**	26.2	2.54
CU 16-3	839	765	302	285	4680	**224.1**	207200		**5315**	**4940**	27.0	2.64
CU 20-3	888	791	318	322	5070	**252.9**	253400		**6095**	**5705**	28.1	2.80
CU 25-3	924	807	329	358	5330	**280.9**	298500		**6990**	**6460**	28.9	2.91
CU 32-3	926	809	331	436	5345	**342.4**	367400		**8585**	**7935**	29.0	2.92
LT2 S	744	661	280	266	3545	**209.1**	145800		**4260**	**3920**	23.4	2.38
LT3 S	776	692	289	302	3790	**236.7**	178100		**4770**	**4590**	24.3	2.47
LT4 S	817	717	303	330	4059	**258.6**	211800		**5385**	**5185**	25.4	2.61

* The mass of the welds is not taken into account.
** Outside surface, excluding inside of interlocks.

BOX PILES

CHARACTERISTICS

U-Box Piles



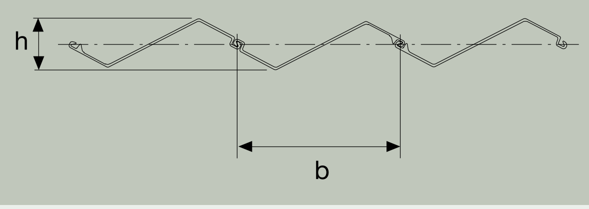
Section	b	h	Peri-meter	Steel sec-tion	Total sec-tion	**Mass***	Moment of inertia y-y	Moment of inertia z-z	**Elastic section modulus y-y**	**Elastic section modulus z-z**	Min. radius of gyration	Coating area**
	mm	mm	cm	cm^2	cm^2	**kg/m**	cm^4	cm^4	**cm^3**	**cm^3**	cm	m^2/m
CAU 14-4	1220	1220	452	397	11122	**311.6**	689860		**11305**		41.7	4.02
CAU 16-4	1225	1225	454	440	11193	**345.0**	770370		**12575**		41.8	4.02
CAU 17-4	1226	1226	454	454	11206	**356.2**	796520		**12990**		41.9	4.02
CAU 18-4	1258	1258	471	451	11728	**354.0**	826550		**13140**		42.8	4.20
CAU 20-4	1261	1261	472	494	11771	**387.6**	910010		**14430**		42.9	4.20
CAU 21-4	1262	1262	473	508	11783	**398.6**	937100		**14855**		43.0	4.20
CAU 23-4	1263	1263	481	520	11977	**408.4**	979870		**15510**		43.4	4.30
CAU 25-4	1266	1266	482	563	12020	**441.6**	1064910		**16820**		43.5	4.30
CAU 26-4	1267	1267	483	577	12033	**452.8**	1093300		**17250**		43.5	4.30
CU 6-4	884	884	355	232	6480	**182.4**	234900		**5315**		31.8	3.04
CU 8-4	941	941	370	278	6978	**218.2**	300200		**6385**		32.9	3.19
CU 12-4	1025	1025	388	337	7565	**264.4**	394000		**7690**		34.2	3.36
CU 12 10/10-4	1025	1025	388	355	7565	**278.4**	414830		**8095**		34.2	3.36
CU 16-4	1044	1044	401	381	7890	**298.8**	468400		**8970**		35.1	3.50
CU 20-4	1096	1096	421	430	8410	**337.2**	562900		**10265**		36.2	3.70
CU 25-4	1118	1118	437	477	8760	**374.4**	656800		**11745**		37.1	3.86
CU 32-4	1120	1120	440	582	8782	**456.6**	811100		**14480**		37.3	3.87
LQ 2 S	908	908	371	355	5903	**278.8**	325000		**7160**		30.2	3.14
LQ 3 S	969	969	383	402	6231	**315.6**	391700		**8080**		31.2	3.27
LQ 4 S	1009	1009	401	439	6590	**344.8**	458900		**9090**		32.3	3.45

* The mass of the welds is not taken into account.
** Outside surface, excluding inside of interlocks.

SPECIAL COMBINATIONS

CHARACTERISTICS

AZ Jagged Wall



Threaded in a reverse position AZ sections may form arrangements for special applications.
For sealing screens this arrangement represents a most economical solution (reduced height, reliable thickness, low driving resistance).

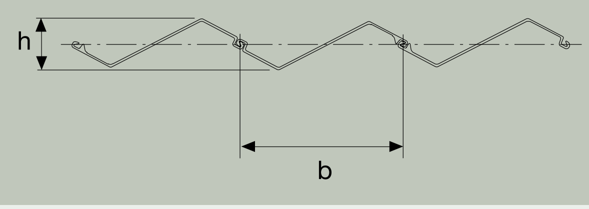
Section	Dimensions b in	Dimensions h in	Sectional area in²/ft	**Mass lb/ft²**	Moment of interia in⁴/ft	**Elastic section modulus in³/ft**	Coating area* ft²/ft²
AZ 12	28.27	7.28	5.53	**18.86**	18.6	**5.1**	1.14
AZ 13	28.27	7.32	6.05	**20.54**	20.8	**5.7**	1.14
AZ 14	28.27	7.36	6.57	**22.35**	22.9	**6.2**	1.14
AZ 17	28.11	8.78	5.76	**19.62**	28.1	**6.4**	1.19
AZ 18	28.11	8.86	6.28	**21.34**	31.3	**7.1**	1.19
AZ 19	28.11	8.90	6.80	**23.23**	34.6	**7.8**	1.19
AZ 25	28.98	9.33	7.46	**25.46**	44.5	**9.6**	1.21
AZ 26	28.98	9.37	7.98	**27.22**	48.3	**10.3**	1.21
AZ 28	28.98	9.41	8.55	**29.04**	52.1	**11.1**	1.21
AZ 34	29.65	10.31	9.21	**31.42**	71.3	**13.9**	1.23
AZ 36	29.65	10.35	9.78	**33.24**	76.0	**14.7**	1.23
AZ 38	29.65	10.39	10.30	**35.11**	80.8	**15.5**	1.23
AZ 46	28.54	12.13	11.01	**37.46**	121.2	**19.9**	1.30
AZ 48	28.54	12.20	11.57	**39.45**	127.8	**20.9**	1.30
AZ 50	28.54	12.28	12.19	**41.43**	134.5	**21.9**	1.30
For minimum steel thicknesses of 0.394 in (10 mm):							
AZ 13 10/10	28.27	7.36	6.28	**21.44**	21.8	**6.0**	1.14
AZ 18 10/10	28.11	8.86	6.57	**22.32**	33.0	**7.4**	1.19
For minimum steel thicknesses of 0.5 in (12.7 mm):							
AZ 26 + 0.5	28.98	9.37	8.27	**28.14**	50.2	**10.7**	1.21

* On both sides, excluding inside of interlocks.

SPECIAL COMBINATIONS

CHARACTERISTICS

AZ *Jagged Wall*



Threaded in a reverse position AZ sections may form arrangements for special applications.
For sealing screens this arrangement represents a most economical solution (reduced height, reliable thickness, low driving resistance).

Section	Dimensions b mm	Dimensions h mm	Sectional area cm²/m	**Mass kg/m²**	Moment of interia cm⁴/m	**Elastic section modulus cm³/m**	Coating area* m²/m²
AZ 12	718	185	117	**92.1**	2540	**275**	1.14
AZ 13	718	186	128	**100.3**	2840	**305**	1.14
AZ 14	718	187	139	**109.1**	3130	**335**	1.14
AZ 17	714	223	122	**95.8**	3840	**345**	1.19
AZ 18	714	225	133	**104.2**	4280	**380**	1.19
AZ 19	714	226	144	**113.4**	4720	**420**	1.19
AZ 25	736	237	158	**124.3**	6070	**515**	1.21
AZ 26	736	238	169	**132.9**	6590	**555**	1.21
AZ 28	736	239	181	**141.8**	7110	**595**	1.21
AZ 34	753	262	195	**153.4**	9730	**745**	1.23
AZ 36	753	263	207	**162.3**	10380	**790**	1.23
AZ 38	753	264	218	**171.4**	11040	**835**	1.23
AZ 46	725	308	233	**182.9**	16550	**1070**	1.30
AZ 48	725	310	245	**192.6**	17450	**1125**	1.30
AZ 50	725	312	258	**202.3**	18370	**1180**	1.30
For minimum steel thicknesses of 10 mm:							
AZ 13 10/10	718	187	133	**104.7**	2980	**320**	1.14
AZ 18 10/10	714	225	139	**109.0**	4500	**400**	1.19
For minimum steel thicknesses of 12.7 mm:							
AZ 26 + 0.5	736	238	175	**137.4**	6850	**575**	1.21

* On both sides, excluding inside of interlocks.

SPECIAL COMBINATIONS

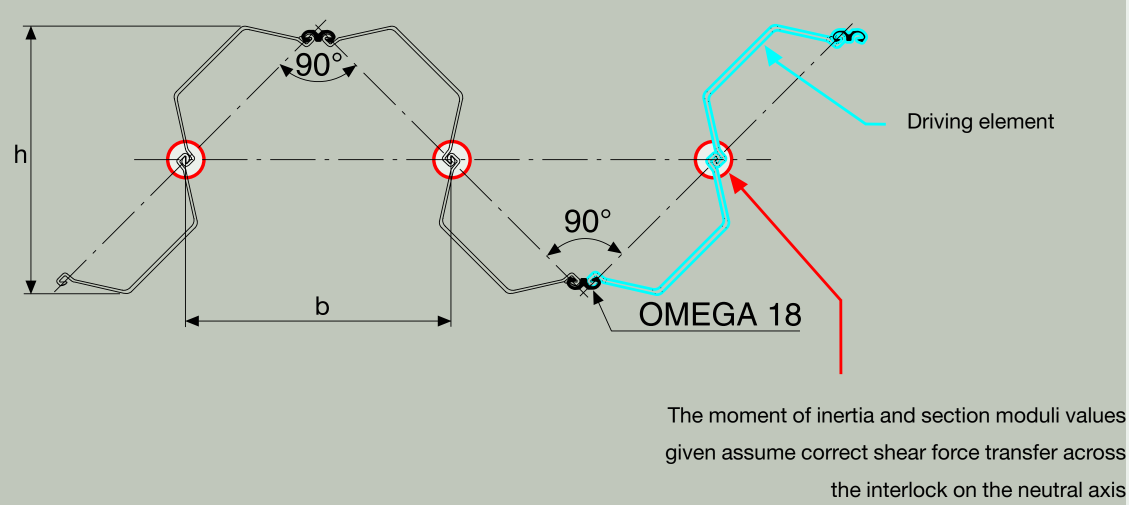
CHARACTERISTICS

U Jagged Wall

An arrangement of U sheet piles into a jagged wall offers economic solutions where high inertia and section modulus are needed. Final choice of section has to include drivability criteria. The statical values given on the next page assume the solidarization of the driving element, i.e. double pile. (see picture below)

Generally the OMEGA 18 section is threaded and welded at the mill. The OMEGA 18 section may either be tack welded for handling reasons to the double pile, then its contribution to the section modulus of the jagged wall has to be disregarded, or it is welded with an accordingly designed weld, then it fully contributes to the section modulus. See different columns in the table on the next page.

For walls with an anchorage or strut system, stiffeners have to be provided at the support levels.



SPECIAL COMBINATIONS

CHARACTERISTICS

Section	Width	Height	**Mass**	Moment of inertia		**Elastic section modulus**		Static moment	
	b mm	h mm	**kg/m²**	without OMEGA 18 cm⁴/m	with OMEGA 18 cm⁴/m	**without OMEGA 18 cm³/m**	**with OMEGA 18 cm³/m**	without OMEGA 18 cm³/m	with OMEGA 18 cm³/m
AU 14	1135	1115	**153.2**	275830	334350	**4945**	**5995**	6160	7250
AU 16	1135	1115	**167.9**	307000	365520	**5505**	**6555**	6870	7960
AU 17	1135	1115	**172.8**	317400	375920	**5690**	**6740**	7110	8195
AU 18	1135	1136	**171.9**	329320	387840	**5795**	**6825**	7180	8270
AU 20	1135	1139	**186.7**	362510	421030	**6365**	**7395**	7920	9005
AU 21	1135	1139	**191.5**	373310	431820	**6555**	**7580**	8160	9250
AU 23	1135	1171	**195.8**	390650	449160	**6675**	**7675**	8470	9560
AU 25	1135	1173	**210.5**	424510	483020	**7240**	**8235**	9215	10300
AU 26	1135	1174	**215.4**	435820	494340	**7425**	**8425**	9465	10550
PU 6	923	903	**118.5**	113200	152100	**2510**	**3370**	3290	4365
PU 8	923	903	**137.8**	144600	184500	**3200**	**4085**	4070	5140
PU 12	923	903	**162.8**	189000	229900	**4185**	**5090**	5175	6245
PU 12 10/10	923	903	**170.4**	198850	245250	**4405**	**5430**	5450	6525
PU 16	923	929	**181.5**	225100	266600	**4845**	**5740**	6065	7140
PU 20	923	971	**202.3**	270600	312700	**5575**	**6440**	7065	8140
PU 25	923	1010	**222.5**	316500	359000	**6265**	**7105**	8105	9175
PU 32	923	1011	**267.0**	389300	432400	**7705**	**8560**	10025	11095
L 2 S	781	815	**201.6**	179700	213700	**4405**	**5240**	5665	6725
L 3 S	781	827	**225.1**	216600	251000	**5235**	**6070**	6655	7720
L 4 S	781	865	**243.9**	254700	289500	**5890**	**6695**	7595	8655

COMBINED WALLS

Sheet piles can easily be combined to form special arrangements for construction of walls with great resistance to bending:

– sheet pile walls reinforced with integrated box piles,
– combined walls like box piles / sheet piles, wide flange beams / sheet-piles, tubes / sheet piles.

The primary piles in the combined walls very often also have the function of bearing piles taking important vertical loads, as occurs for instance in very high quay walls.

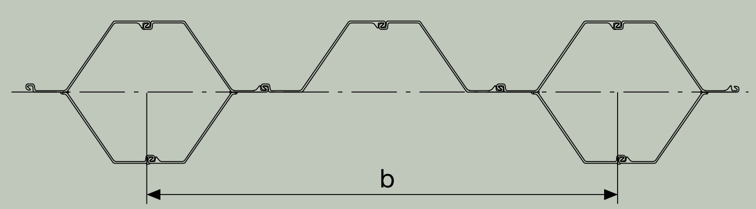
Determination of the equivalent section modulus

For a combined wall, the equivalent elastic section modulus per linear meter of wall is defined on the basis of the fact that the deflections of the primary piles and intermediate sheet piles have to be the same, leading to:

$$\textbf{equivalent el. section modulus} = \text{el. section modulus (primary pile)} \times \frac{1 + \dfrac{\text{moment of inertia (sheet piles)}}{\text{moment of inertia (primary pile)}}}{b}$$

Combinations

AZ Box Piles – AZ Sheet Piles



Section	Dimension b in	Mass ℓ of intermediates = 100% ℓ box piles lb/ft²	Mass ℓ of intermediates = 60% ℓ box piles lb/ft²	Moment of inertia in⁴/ft	**Elastic section modulus in³/ft**
CAZ 13 / AZ 13	105.51	**30.11**	**25.81**	446.0	**37.2**
CAZ 18 / AZ 13	102.36	**31.95**	**27.45**	702.3	**46.7**
CAZ 18 / AZ 18	99.21	**33.38**	**28.47**	773.0	**51.4**
CAZ 26 / AZ 13	102.36	**38.51**	**34.00**	1107.5	**65.7**
CAZ 26 / AZ 18	99.21	**40.14**	**35.43**	1191.2	**70.6**
CAZ 36 / AZ 13	102.36	**45.26**	**40.76**	1589.3	**87.4**
CAZ 36 / AZ 18	99.21	**47.11**	**42.19**	1688.2	**92.8**
CAZ 48 / AZ 13	98.43	**52.23**	**47.52**	2072.7	**108.8**
CAZ 48 / AZ 18	95.28	**54.28**	**49.36**	2191.7	**115.1**

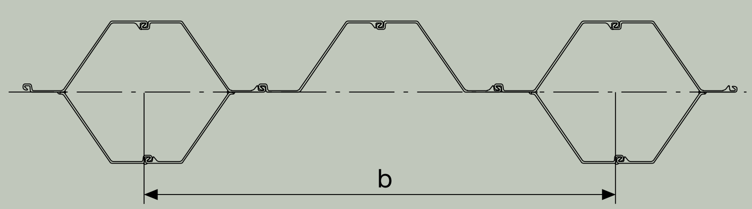
Determination of the equivalent section modulus

For a combined wall, the equivalent elastic section modulus per linear meter of wall is defined on the basis of the fact that the deflections of the primary piles and intermediate sheet piles have to be the same, leading to:

$$\textbf{equivalent el. section modulus} = \text{el. section modulus (primary pile)} \times \frac{1 + \dfrac{\text{moment of inertia (sheet piles)}}{\text{moment of inertia (primary pile)}}}{b}$$

Combinations

AZ Box Piles – AZ Sheet Piles



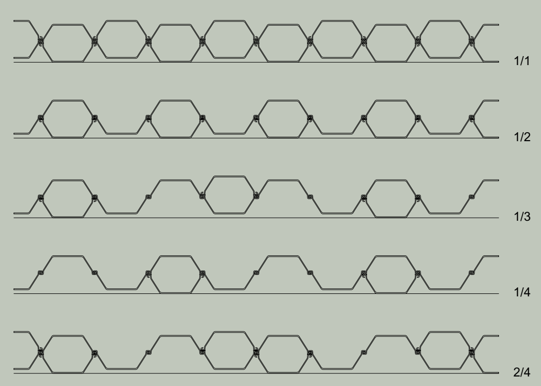
Section	Dimension b mm	**Mass** **ℓ of intermediates =** **100%** **ℓ box piles** **kg/m²**	 **60%** **kg/m²**	Moment of inertia cm⁴/m	**Elastic section modulus** **cm³/m**
CAZ 13 / AZ 13	2680	**147**	**126**	60910	**2000**
CAZ 18 / AZ 13	2600	**156**	**134**	95900	**2510**
CAZ 18 / AZ 18	2520	**163**	**139**	105560	**2765**
CAZ 26 / AZ 13	2600	**188**	**166**	151240	**3530**
CAZ 26 / AZ 18	2520	**196**	**173**	162660	**3795**
CAZ 36 / AZ 13	2600	**221**	**199**	217030	**4700**
CAZ 36 / AZ 18	2520	**230**	**206**	230540	**4990**
CAZ 48 / AZ 13	2500	**255**	**232**	283040	**5850**
CAZ 48 / AZ 18	2420	**265**	**241**	299290	**6190**

Combinations

U Box Piles – U Sheet Piles

Type of reinforcement
The reinforcement may be:
1. Heightwise:
   – full height: reinforcing box piles
   – partial height: forming sheet piles with inertia change by welding specially prepared shorter piles onto them.
2. Lengthwise:
   – total length: reinforcement 1/1
   – partial length: reinforcement 1/2, 1/3, 1/4.

For other combinations (e.g. 2/4) please contact our Technical Department.



Section	1/1			1/2			1/3			1/4		
	Mass kg/m²	Moment of inertia cm⁴/m	Elastic section modulus cm³/m	Mass kg/m²	Moment of inertia cm⁴/m	Elastic section modulus cm³/m	Mass kg/m²	Moment of inertia cm⁴/m	Elastic section modulus cm³/m	Mass kg/m²	Moment of inertia cm⁴/m	Elastic section modulus cm³/m
AU 14	**207.8**	71800	**3200**	**155.8**	40290	**1795**	**138.5**	43070	**1920**	**129.8**	37820	**1685**
AU 16	**230.0**	82990	**3660**	**172.5**	46230	**2035**	**153.3**	49560	**2185**	**143.7**	43440	**1915**
AU 17	**237.5**	86450	**3805**	**178.1**	48070	**2115**	**158.3**	51660	**2275**	**148.4**	45270	**1990**
AU 18	**236.0**	98360	**4045**	**177.0**	55020	**2260**	**157.3**	58990	**2425**	**147.5**	51760	**2130**
AU 20	**258.4**	111160	**4545**	**193.8**	61830	**2525**	**172.3**	66680	**2725**	**161.5**	58460	**2390**
AU 21	**265.7**	115390	**4705**	**199.3**	64080	**2615**	**177.2**	69250	**2825**	**166.1**	60700	**2475**
AU 23	**272.2**	126050	**5125**	**204.2**	69580	**2830**	**181.5**	75820	**3080**	**170.2**	66410	**2700**
AU 25	**294.4**	139750	**5645**	**220.8**	76800	**3105**	**196.3**	84080	**3395**	**184.0**	73590	**2975**
AU 26	**301.9**	144350	**5820**	**226.4**	79230	**3195**	**201.2**	86880	**3505**	**188.7**	76020	**3065**
PU 12	**220.3**	56670	**2810**	**165.2**	32080	**1590**	**146.9**	33290	**1650**	**137.7**	29190	**1450**
PU 12 10/10	**232.0**	59300	**2945**	**174.0**	33480	**1660**	**154.6**	34820	**1730**	**145.0**	30520	**1515**
PU 16	**249.0**	78000	**3690**	**186.8**	43670	**2065**	**166.0**	46270	**2190**	**155.6**	40550	**1915**
PU 20	**281.0**	108550	**4570**	**210.8**	60940	**2565**	**187.4**	64850	**2730**	**175.6**	56910	**2395**
PU 25	**312.0**	140560	**5655**	**234.0**	78230	**3150**	**208.0**	84510	**3400**	**194.9**	74120	**2985**
PU 32	**380.5**	181330	**7270**	**285.3**	99790	**4000**	**253.6**	108660	**4355**	**237.8**	95070	**3810**
L 2 S	**278.8**	72200	**3755**	**209.1**	40540	**2110**	**185.9**	42200	**2195**	**174.3**	36930	**1920**
L 3 S	**315.6**	103600	**4640**	**236.7**	58510	**2620**	**210.4**	61210	**2740**	**197.2**	53690	**2405**
L 4 S	**344.8**	139200	**5725**	**258.6**	78250	**3215**	**229.8**	83070	**3415**	**215.5**	72920	**3000**

COMBINED WALLS

HZ/AZ SYSTEM

The HZ/AZ wall is a combined system incorporating :
– HZ king piles as structural supports,
– AZ sheet piles as intermediary elements,
– special connectors.

Systemwise assembly of these basic elements yields a full range of standard solutions.

All combinations are based on the same principle: structural supports comprising one or more HZ primary pile sections alternating with intermediary double AZ sheet pile sections.

Structurally, the HZ primary piles fulfill two different functions :
– as retaining members, they resist horizontal loads resulting from earth and hydrostatic pressures,
– as bearing piles, they transfer vertical loads into the ground.

The intermediary sheet piles have only an earth-retaining and load-transfer function and they may be shorter than the HZ primary piles.

The range of sectional combinations of the HZ System is characterized by loadings which can not be covered by conventional sheet piling. Depending on the structural combination and steelgrade adopted, bending moments up to 9000 kNm/m can be safely resisted.

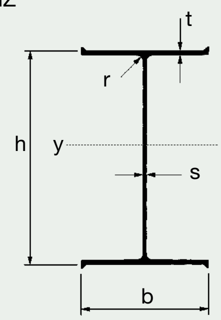
Concurrently, an excellent section-modulus-to-weight ratio ensures economical design.

The outstanding feature of this combination is the extensive range of possible combinations using the entire AZ sheet pile offer.

See also our special HZ/AZ System catalogue.

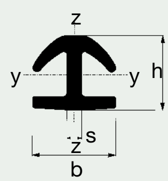
HZ/AZ System
Single Elements

HZ



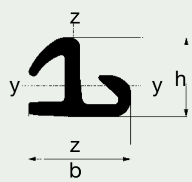
Section	h in	b in	t in	s in	r in	Sectional area in²	**Mass lb/ft**	Moment of inertia y-y in⁴	**Elastic section modulus y-y in³**	Perimeter ft²/ft	Interlocking section
HZ 575 A	22.64	18.11	0.551	0.433	0.79	31.08	**105.77**	3023.1	**267.0**	9.88	RH16-RZ16
HZ 575 B	22.80	18.11	0.630	0.433	0.79	33.93	**115.44**	3393.3	**297.8**	9.91	RH16-RZ16
HZ 575 C	22.95	18.15	0.709	0.472	0.79	37.73	**128.41**	3815.2	**332.6**	9.94	RH16-RZ16
HZ 575 D	23.11	18.15	0.787	0.472	0.79	40.59	**138.09**	4196.7	**363.1**	9.97	RH20-RZ18
HZ 775 A	30.51	18.11	0.669	0.492	0.79	39.97	**136.01**	6728.7	**441.2**	11.12	RH16-RZ16
HZ 775 B	30.67	18.11	0.748	0.492	0.79	42.83	**145.75**	7398.0	**482.4**	11.15	RH16-RZ16
HZ 775 C	30.83	18.17	0.827	0.551	0.79	47.55	**161.81**	8232.9	**534.3**	11.19	RH20-RZ18
HZ 775 D	30.98	18.17	0.906	0.551	0.79	50.42	**171.55**	8918.6	**575.8**	11.22	RH20-RZ18
HZ 975 A	38.39	18.11	0.669	0.551	0.79	46.04	**156.64**	11452.2	**596.8**	12.43	RH16-RZ16
HZ 975 B	38.54	18.11	0.748	0.551	0.79	48.89	**166.38**	12509.8	**649.0**	12.43	RH16-RZ16
HZ 975 C	38.70	18.19	0.827	0.630	0.79	54.85	**186.67**	13986.6	**722.8**	12.50	RH20-RZ18
HZ 975 D	38.86	18.19	0.906	0.630	0.79	57.72	**196.42**	15066.6	**775.6**	12.50	RH20-RZ18

RH



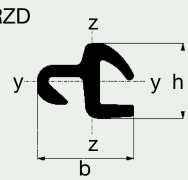
Section	h in	b in	t in	s in	r in	Sectional area in²	**Mass lb/ft**	Moment of inertia y-y in⁴	**Elastic section modulus y-y in³**	Perimeter ft²/ft	Interlocking section
RH 16	2.43	2.69	–	0.480	–	3.16	**10.75**	2.0	**1.6**	–	–
RH 20	2.65	3.12	–	0.559	–	3.95	**13.44**	3.0	**2.1**	–	–

RZU



Section	h in	b in	t in	s in	r in	Sectional area in²	**Mass lb/ft**	Moment of inertia y-y in⁴	**Elastic section modulus y-y in³**	Perimeter ft²/ft	Interlocking section
RZU 16	2.43	3.13	–	–	–	3.19	**10.83**	1.7	**1.1**	–	–
RZU 18	2.65	3.31	–	–	–	3.55	**12.03**	2.3	**1.4**	–	–

RZD



Section	h in	b in	t in	s in	r in	Sectional area in²	**Mass lb/ft**	Moment of inertia y-y in⁴	**Elastic section modulus y-y in³**	Perimeter ft²/ft	Interlocking section
RZD 16	2.43	3.13	–	–	–	3.19	**10.89**	1.4	**1.1**	–	–
RZD 18	2.65	3.31	–	–	–	3.55	**12.13**	1.9	**1.4**	–	–

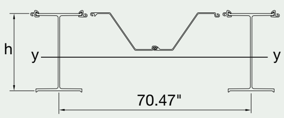
All the components of HZ/AZ System available in ASTM A690 steel grade.

COMBINED WALLS

CHARACTERISTICS

Section	Profil	Dimension h (in)	Properties per ft of wall: Sectional area (in²/ft)	Moment of inertia (in⁴/ft)	Elastic* section modulus (in³/ft)	**Elastic** section modulus (in³/ft)**	Mass***: ℓ AZ = 60 % ℓ HZ (lb/ft²)	ℓ AZ = ℓ HZ (lb/ft²)	Coating area: Water-side (ft²/ft)
Combination HZ … -12 / AZ 18	**HZ 575 A**	22.64	11.38	806.3	75.1	**60.9**	30.44	38.73	7.65
	HZ 575 B	22.80	11.87	871.8	80.0	**66.1**	32.10	40.39	7.65
	HZ 575 C	22.95	12.51	947.2	85.1	**72.2**	34.30	42.59	7.65
	HZ 575 D	23.11	13.13	1023.9	91.6	**77.3**	36.21	44.67	7.70
	HZ 775 A	30.51	12.90	1537.8	106.4	**88.6**	35.60	43.89	7.65
	HZ 775 B	30.67	13.38	1654.9	113.4	**95.6**	37.25	45.54	7.65
	HZ 775 C	30.83	14.31	1820.0	123.9	**104.7**	40.25	48.71	7.70
	HZ 775 D	30.98	14.80	1939.2	130.9	**111.7**	41.91	50.37	7.70
	HZ 975 A	38.39	13.93	2474.0	136.5	**114.9**	39.11	47.40	7.65
	HZ 975 B	38.54	14.41	2658.7	145.4	**123.8**	40.76	49.05	7.65
	HZ 975 C	38.70	15.56	2948.3	160.1	**136.9**	44.48	52.94	7.70
	HZ 975 D	38.86	16.04	3136.1	169.2	**145.7**	46.14	54.60	7.70
Combination HZ … -24 / AZ 18	**HZ 575 A**	22.64	14.00	1161.4	85.3	**94.6**	39.94	47.63	9.41
	HZ 575 B	22.80	14.76	1262.9	92.9	**102.8**	42.54	50.24	9.41
	HZ 575 C	22.95	15.78	1379.9	101.5	**112.2**	46.02	53.71	9.41
	HZ 575 D	23.11	16.86	1519.4	110.9	**122.6**	49.27	57.38	9.48
	HZ 775 A	30.51	16.39	2327.4	132.4	**142.8**	48.07	55.76	9.40
	HZ 775 B	30.67	17.15	2510.0	143.0	**153.8**	50.68	58.37	9.40
	HZ 775 C	30.83	18.73	2801.4	158.8	**170.9**	55.64	63.75	9.47
	HZ 775 D	30.98	19.50	2987.5	169.6	**181.9**	58.25	66.37	9.47
	HZ 975 A	38.39	18.01	3819.9	176.8	**187.7**	53.61	61.30	9.40
	HZ 975 B	38.54	18.78	4108.5	190.1	**201.6**	56.21	63.91	9.40
	HZ 975 C	38.70	20.69	4613.1	212.8	**225.7**	62.31	70.43	9.47
	HZ 975 D	38.86	21.46	4906.9	226.4	**239.7**	64.93	73.04	9.47

Combination HZ … -12 / AZ 18:

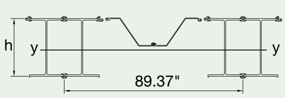


* Referring to outside of connector

** Referring to outside of AZ-flange

*** Length of connector = Length of AZ

Combination HZ … -24 / AZ 18:

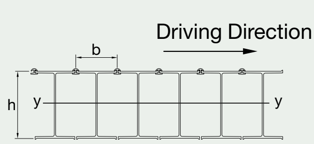


* Referring to outside of connector

** Referring to outside of HZ-flange

*** Length of connector = Length of AZ

Section	Profil	Dimension b (in)	Dimension h (in)	Properties per ft of wall: Sectional area (in²/ft)	Moment of inertia (in⁴/ft)	Elastic* section modulus (in³/ft)	**Elastic** section modulus (in³/ft)**	Mass (lb/ft²)	Coating area: Water-side (ft²/ft)
Combination C1	**HZ 575 A**	18.70	22.64	21.97	2179.3	187.8	**176.2**	74.75	1.75
	HZ 575 B	18.70	22.80	23.80	2420.5	206.6	**195.7**	80.98	1.75
	HZ 575 C	18.74	22.95	26.18	2691.1	226.5	**217.6**	89.10	1.75
	HZ 575 D	18.82	23.11	28.40	2977.6	251.4	**236.9**	96.65	1.78
	HZ 775 A	18.70	30.51	27.68	4755.9	308.7	**290.4**	94.19	1.75
	HZ 775 B	18.70	30.67	29.51	5190.0	334.5	**316.8**	100.41	1.75
	HZ 775 C	18.86	30.83	32.77	5778.3	373.0	**348.5**	111.54	1.77
	HZ 775 D	18.86	30.98	34.59	6218.4	399.3	**374.6**	117.73	1.77
	HZ 975 A	18.70	38.39	31.56	8047.3	418.8	**394.0**	107.42	1.75
	HZ 975 B	18.70	38.54	33.39	8732.8	451.6	**427.2**	113.65	1.75
	HZ 975 C	18.90	38.70	37.34	9742.2	504.6	**472.1**	127.09	1.77
	HZ 975 D	18.90	38.86	39.16	10434.4	537.8	**505.1**	133.28	1.77

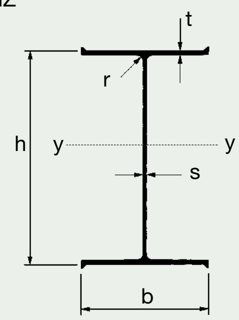


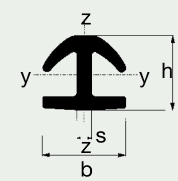
* Referring to outside of connector

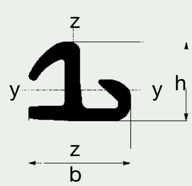
** Referring to outside of HZ-flange

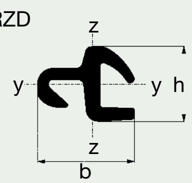
HZ/AZ System
Single Elements

Section	Dimensions h mm	b mm	t mm	s mm	r mm	Sectional area cm²	**Mass kg/m**	Moment of inertia y-y cm⁴	**Elastic section modulus y-y cm³**	Perimeter m²/m	Interlocking section
HZ											
HZ 575 A	575.0	460.0	14.0	11.0	20	200.5	**157.4**	125830	**4375**	3.01	RH16-RZ16
HZ 575 B	579.0	460.0	16.0	11.0	20	218.9	**171.8**	141240	**4880**	3.02	RH16-RZ16
HZ 575 C	583.0	461.0	18.0	12.0	20	243.4	**191.1**	158800	**5450**	3.03	RH16-RZ16
HZ 575 D	587.0	461.0	20.0	12.0	20	261.9	**205.5**	174680	**5950**	3.04	RH20-RZ18
HZ 775 A	775.0	460.0	17.0	12.5	20	257.9	**202.4**	280070	**7230**	3.39	RH16-RZ16
HZ 775 B	779.0	460.0	19.0	12.5	20	276.3	**216.9**	307930	**7905**	3.40	RH16-RZ16
HZ 775 C	783.0	461.5	21.0	14.0	20	306.8	**240.8**	342680	**8755**	3.41	RH20-RZ18
HZ 775 D	787.0	461.5	23.0	14.0	20	325.3	**255.3**	371220	**9435**	3.42	RH20-RZ18
HZ 975 A	975.0	460.0	17.0	14.0	20	297.0	**233.1**	476680	**9780**	3.79	RH16-RZ16
HZ 975 B	979.0	460.0	19.0	14.0	20	315.4	**247.6**	520700	**10640**	3.79	RH16-RZ16
HZ 975 C	983.0	462.0	21.0	16.0	20	353.9	**277.8**	582170	**11845**	3.81	RH20-RZ18
HZ 975 D	987.0	462.0	23.0	16.0	20	372.4	**292.3**	627120	**12710**	3.81	RH20-RZ18
RH											
RH 16	61.8	68.2	–	12.2	–	20.4	**16.0**	82.7	**25.5**	–	–
RH 20	67.3	79.2	–	14.2	–	25.5	**20.0**	122.8	**33.7**	–	–
RZU											
RZU 16	61.8	79.5	–	–	–	20.6	**16.12**	69.6	**18.4**	–	–
RZU 18	67.3	84.0	–	–	–	22.9	**17.90**	94.6	**22.8**	–	–
RZD											
RZD 16	61.8	79.5	–	–	–	20.6	**16.21**	57.8	**18.5**	–	–
RZD 18	67.3	84.0	–	–	–	22.9	**18.05**	79.5	**22.4**	–	–

HZ


RH


RZU


RZD


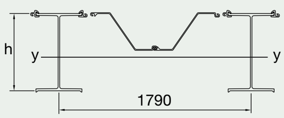
All the components of HZ/AZ System available in ASTM A690 steel grade.

HZ/AZ SYSTEM

COMBINED WALLS

CHARACTERISTICS

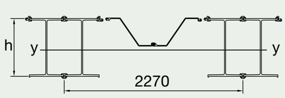
Combination HZ … -12 / AZ 18



Profil / Section	Dimension h (mm)	Properties per meter of wall: Sectional area (cm^2/m)	Moment of inertia (cm^4/m)	Elastic* section modulus (cm^3/m)	**Elastic** section modulus (cm^3/m)**	Mass***: ℓ AZ = 60 % ℓ HZ (kg/m^2)	Mass***: ℓ AZ = ℓ HZ (kg/m^2)	Coating area: Water-side (m^2/m)
HZ 575 A	575.0	240.9	110100	4040	**3275**	149	189	2.332
HZ 575 B	579.0	251.2	119050	4300	**3555**	157	197	2.332
HZ 575 C	583.0	264.9	129350	4575	**3880**	167	208	2.332
HZ 575 D	587.0	277.8	139820	4925	**4155**	177	218	2.348
HZ 775 A	775.0	273.0	210000	5720	**4765**	174	214	2.332
HZ 775 B	779.0	283.3	225980	6095	**5140**	182	222	2.332
HZ 775 C	783.0	303.0	248530	6660	**5630**	197	238	2.346
HZ 775 D	787.0	313.3	264810	7040	**6005**	205	246	2.346
HZ 975 A	975.0	294.8	337840	7340	**6180**	191	231	2.332
HZ 975 B	979.0	305.1	363060	7815	**6655**	199	240	2.332
HZ 975 C	983.0	329.3	402610	8610	**7360**	217	258	2.347
HZ 975 D	987.0	339.6	428250	9095	**7835**	225	267	2.347

* Referring to outside of connector
** Referring to outside of HZ-flange
*** Length of connector = Length of AZ

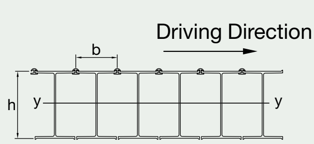
Combination HZ … -24 / AZ 18



Profil / Section	Dimension h (mm)	Properties per meter of wall: Sectional area (cm^2/m)	Moment of inertia (cm^4/m)	Elastic* section modulus (cm^3/m)	**Elastic** section modulus (cm^3/m)**	Mass***: ℓ AZ = 60 % ℓ HZ (kg/m^2)	Mass***: ℓ AZ = ℓ HZ (kg/m^2)	Coating area: Water-side (m^2/m)
HZ 575 A	575.0	296.2	158590	4585	**5085**	195	233	2.867
HZ 575 B	579.0	312.4	172460	4995	**5525**	208	245	2.867
HZ 575 C	583.0	334.1	188440	5455	**6030**	225	262	2.867
HZ 575 D	587.0	356.9	207480	5965	**6590**	241	280	2.889
HZ 775 A	775.0	346.8	317820	7120	**7675**	235	272	2.866
HZ 775 B	779.0	363.0	342750	7690	**8270**	247	285	2.866
HZ 775 C	783.0	396.5	382550	8540	**9190**	272	311	2.886
HZ 775 D	787.0	412.8	407960	9120	**9780**	284	324	2.886
HZ 975 A	975.0	381.3	521630	9505	**10090**	262	299	2.865
HZ 975 B	979.0	397.5	561040	10220	**10840**	274	312	2.865
HZ 975 C	983.0	438.0	629940	11440	**12135**	304	344	2.888
HZ 975 D	987.0	454.3	670070	12170	**12885**	317	357	2.888

* Referring to outside of connector
** Referring to outside of HZ-flange
*** Length of connector = Length of AZ

Combination C1



Profil / Section	Dimension b (mm)	Dimension h (mm)	Properties per meter of wall: Sectional area (cm^2/m)	Moment of inertia (cm^4/m)	Elastic* section modulus (cm^3/m)	**Elastic** section modulus (cm^3/m)**	Mass (kg/m^2)	Coating area: Water-side (m^2/m)
HZ 575 A	475.0	575.0	464.9	297600	10095	**9475**	365	0.534
HZ 575 B	475.0	579.0	503.7	330530	11105	**10520**	395	0.534
HZ 575 C	476.0	583.0	554.2	367480	12175	**11700**	435	0.534
HZ 575 D	478.0	587.0	601.1	406610	13515	**12735**	472	0.541
HZ 775 A	475.0	775.0	585.8	649450	16595	**15615**	460	0.534
HZ 775 B	475.0	779.0	624.5	708720	17985	**17030**	490	0.534
HZ 775 C	479.0	783.0	693.7	789060	20055	**18735**	545	0.540
HZ 775 D	479.0	787.0	732.3	849160	21470	**20140**	575	0.540
HZ 975 A	475.0	975.0	668.1	1098910	22515	**21185**	524	0.534
HZ 975 B	475.0	979.0	706.8	1192510	24280	**22970**	555	0.534
HZ 975 C	480.0	983.0	790.4	1330350	27130	**25380**	620	0.541
HZ 975 D	480.0	987.0	828.9	1424880	28915	**27155**	651	0.541

* Referring to outside of connector
** Referring to outside of HZ-flange

DRIVING ACCESSORIES

DRIVING ACCESSORIES

DRIVING CAPS – CHARACTERISTICS

A driving cap is a very important accessory, providing good energy transfer between the hammer and the sheet pile section, thus preventing damage to the pile. Impact hammers, especially diesel hammers need a special driving cap.
It is generally made of cast steel, with an arrangement of guiding grooves for the different sheet pile sections on its lower side.
A dolly is fitted into a recess on the top of the driving cap.
Dollies are normally made of wooden or plastic components or a combination of several different elements.
Each driving cap generally fits several sheet pile sections, thus reducing the number required for a whole sheet pile range.

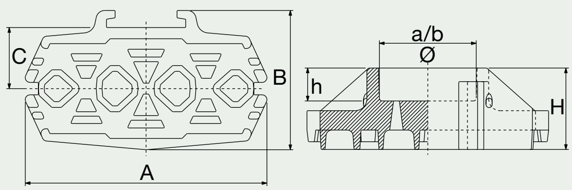
Sheet Pile Sections and Corresponding Driving Caps

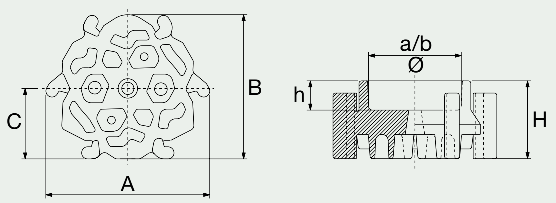
Sections		Driving Caps
L 2 S – L 3 S – L 4 S	singles	LS 2/3/4
L 2 S – L 3 S – L 4 S	doubles	LD 2/3/4
L 2 S – L 3 S – L 4 S	box piles	CLP 500
PU 6-8-12-16-20-25-32	singles	US-B
PU 6-8	doubles	UD 3-B and UD 3
PU 12-16	doubles	UD 1
PU 12	doubles	CD 600 requires slight modification.
PU 16-20-25-32	doubles	UD 2
AU 14-16-17	doubles	AUD 12-16
AU 18-20-21-23-25-26	doubles	AUD 20-32
CU 8-2 / CU 12-2 / CU 16-2	box piles	CLP 600 A
CU 6-2 / CU 20-2	box piles	CLP 600 A requires slight modification.
AZ 12-13-14	doubles	A 13
AZ 17-18-19-25-26-28	doubles	A 18/26
AZ 34-36-38	doubles	A 36
AZ 46-48-50	doubles	A 48
AS 500	singles	CPP 500 A
AS 500	doubles	CPP 500 A

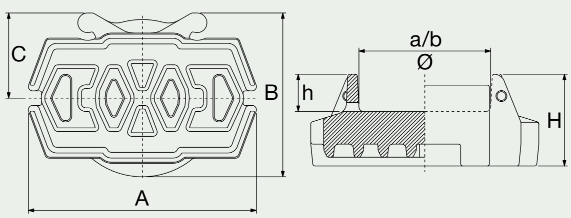
For other driving elements (HZ, built-up box piles, triple piles, etc.) please contact our Technical Department.

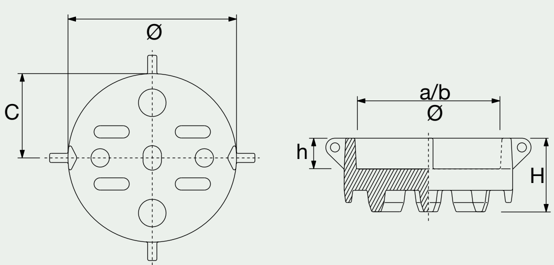
DRIVING ACCESSORIES

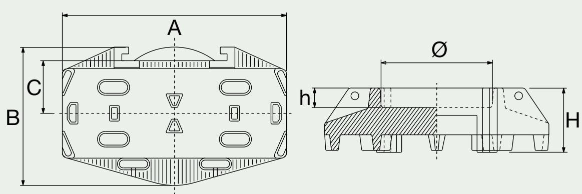
DRIVING CAPS – CHARACTERISTICS

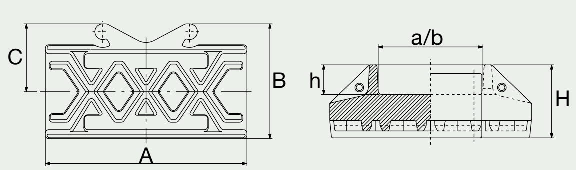












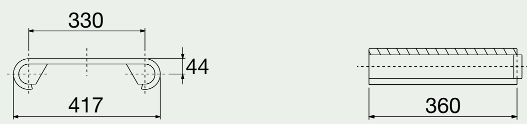
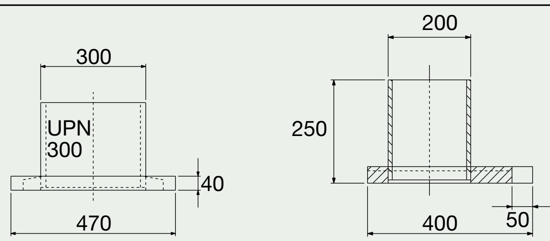
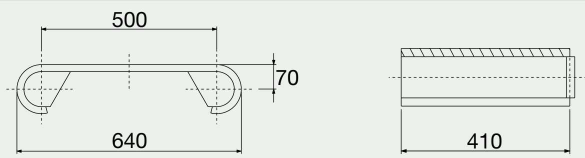
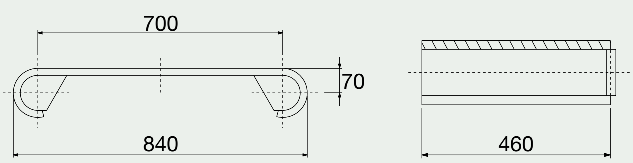
Type	Dimensions A/B (or Ø), H mm	Mass kg	Dimensions of the dolly recess a/b (or Ø), h
UD 1	1252/608/470	1000	Ø 400/170
	C = 260		
UD 2	1248/718/470	1250	Ø 500/170
	C = 315		
UD 3	1244/488/420	700	Ø 300/170
	C = 200		
UD 3-B	1244/488/320	600	500/300/120
	C = 200		
US-B	676/594/370	300	380/380/120
	C = 290		
LS 2/3/4	674/590/390	400	Ø 360/170
	C = 290		
LD 2/3/4	1042/750/420	1000	Ø 600/170
	C = 390		
AUD 12-16	1530/744/520	1900	600/400/170
	C = 430		
AUD 20-32	1573/744/520	2100	600/400/170
	C = 430		
CLP 500	450/520/330	250	350/420/100
	C = 260		
CLP 600 A	Ø 560/330	260	Ø 480/100
	C = 280		
CPP 500 A	940/560/310	380	Ø 480/100
	C = 280		
A 13	1240/548/420	1000	600/300/170
	C = 340		
A 18/26	1160/660/420	1150	600/400/170
	C = 390		
A 36	1180/708/470	1500	600/400/170
	C = 420		
A 48	1080/730/470	1400	600/400/170
	C = 430		

DRIVING ACCESSORIES

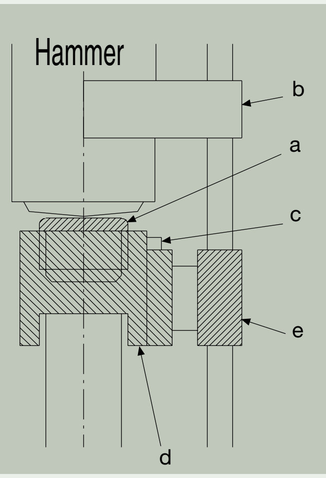
SLIDING GUIDES

Sliding Guides

These pieces are designed to guide the driving cap along the lead, thus guaranteeing proper alignment of the hammer and the center of the cap.

	Designation	
	330/50	fitting US-B and LS cap (adaptation to the leader to be carried out in situ)
	30	fitting UD cap (adaptation to the leader to be carried out in situ)
	500/90	fitting A and LD cap (adaptation to the leader to be carried out in situ)
	700/90	fitting AUD cap (adaptation to the leader to be carried out in situ)

Arrangement of a Driving Cap



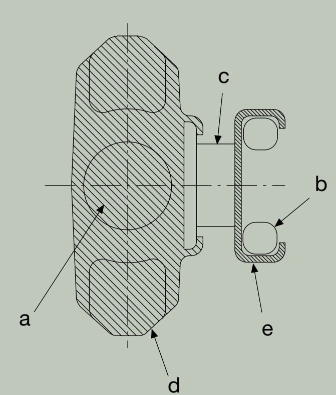
a dolly / cushion

b leader

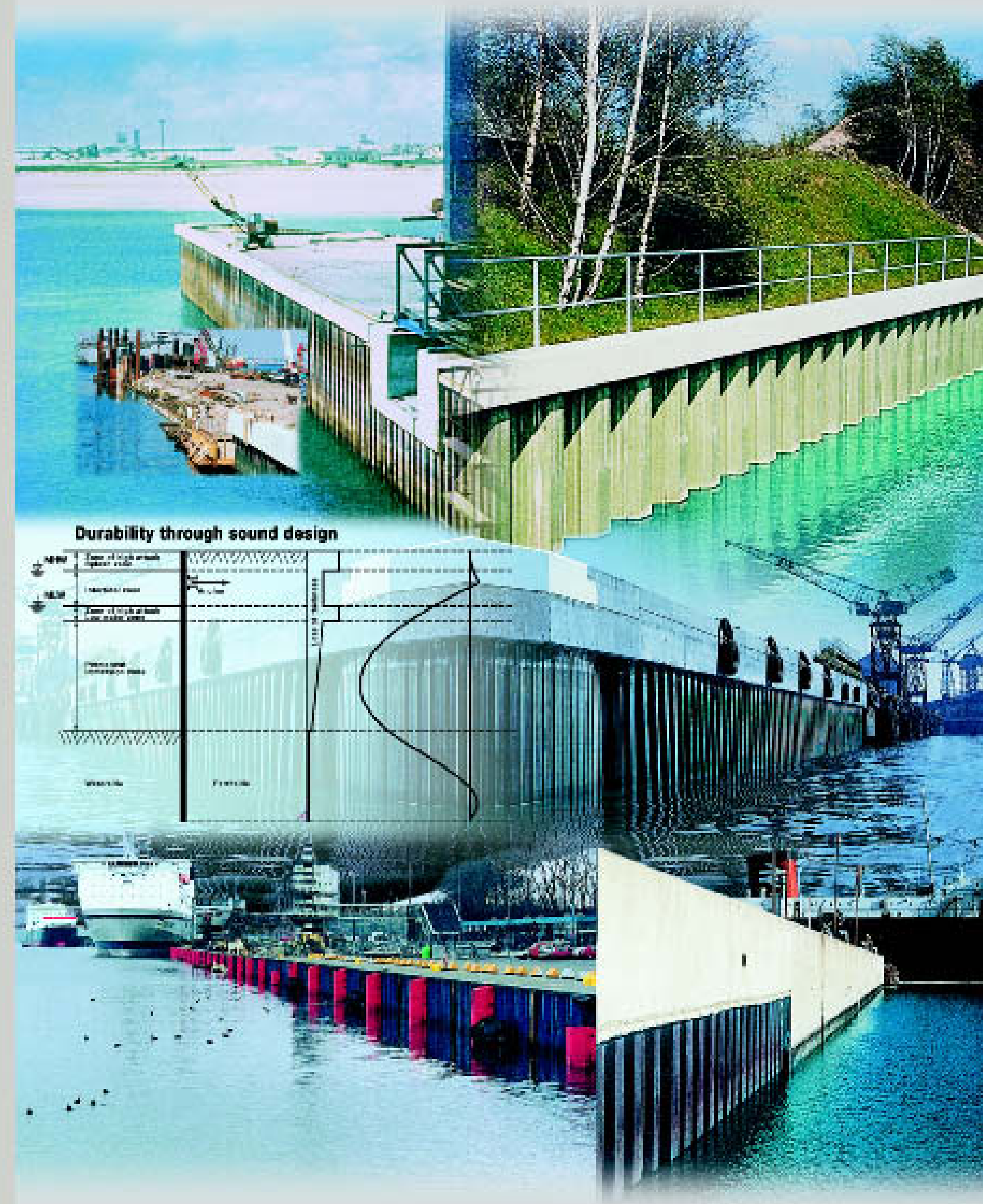
c sliding guide

d driving cap

e leader slide
(not provided by ProfilARBED)



DURABILITY OF SHEET PILES



DURABILITY OF SHEET PILES

Of all possible materials, steel is certainly the most popular and the most suitable for making sheet piling. The reasons are obvious:

– Steel is homogenous, has high elasticity properties and, additionally, allows for a large range of plastic deformations. Therefore steel provides a high degree of reliability with excellent reserves from the point of view of load-carrying capacity.
– The quality and intrinsic integrity of steel is easy to check, wherever the material is accessible and whenever checking is requested.
– After fabrication, steel can still be adapted to all required, and even unforeseen, circumstances by machining, deforming, cutting, reassembling, welding, surface treatment etc.

In contrast with all the above advantages the construction material steel is often criticized over questions of maintenance and certain doubts in respect of the sufficiency of its service lifetime.

Especially for steel sheet piling, which is very often in direct contact with marine or other aggressive environments, the question of corrosion and the consequent undesirable weakening effects is being raised.

Unprotected steel in the atmosphere, in water and in soil is subject to corrosion that may lead to damage. Therefore, to avoid corrosion damage, steel structures are normally protected to withstand corrosion stresses during the required service life.

Local weakening and rusting-through are normally considered to be maintenance problems. They can be remedied locally at the time of their occurrence. However, depending on life-time requirements and accessibility of the structure, it seems preferable to look for appropriate preventive maintenance right at the outset of the installation.

There are different ways of protecting steel sheet pile structures from corrosion:

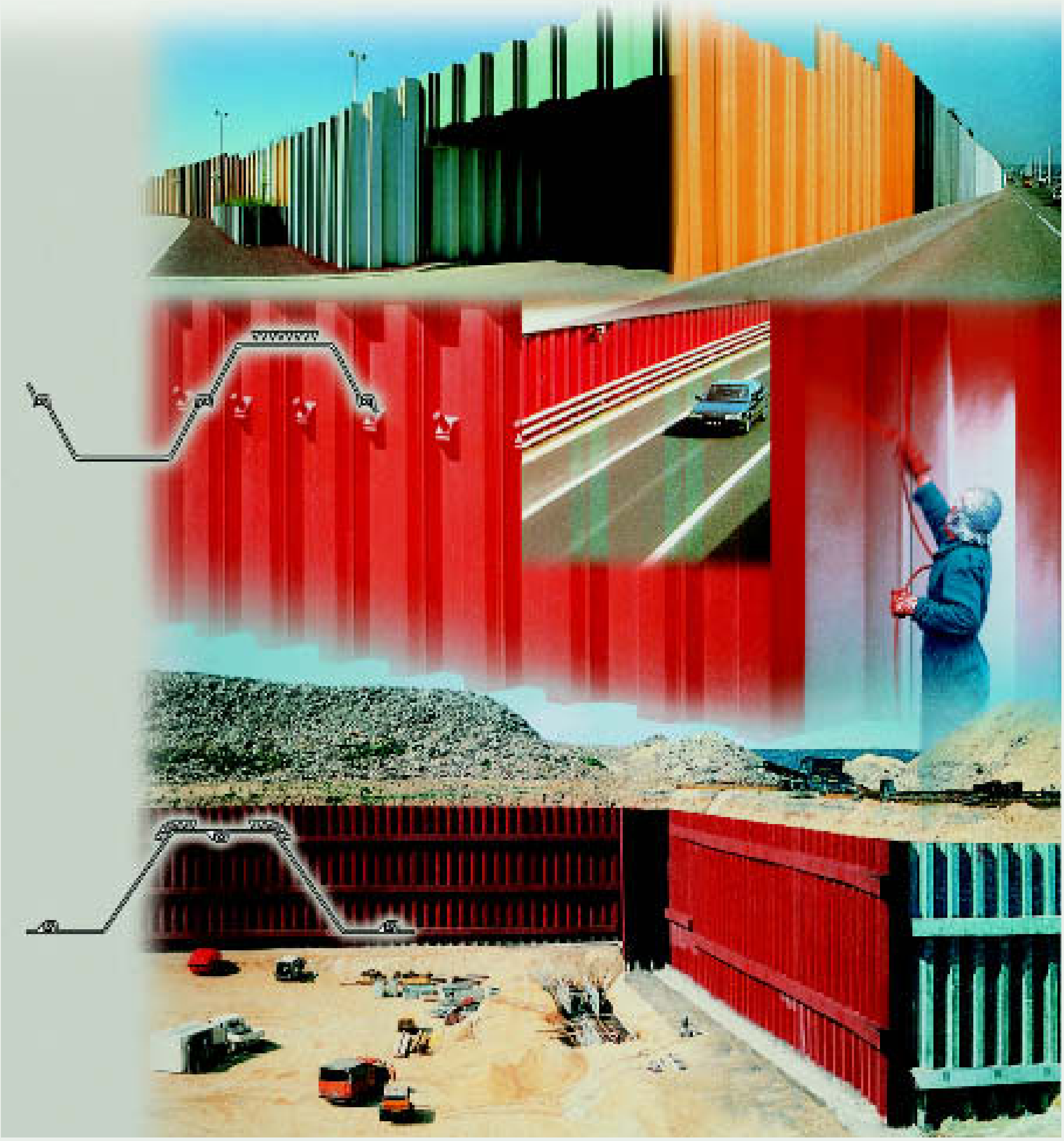
– Corrosion protection by coating, either the full length or only part of the piles,
– The choice of the sheet pile, for instance a minimum wall thickness, a static reserve by choosing a stronger section than statically required, or a higher steel grade,
– Adapting the design to the corrosion intensity, avoiding important bending moments in the high corrosion-rate zones,
– A concrete capping beam extending a certain distance below the low-water level,
– Providing wooden or elastomer fender systems to reduce the abrasion effect,
– Cathodic protection by impressed current or by sacrificial anodes,
– To prevent microbially influenced corrosion, a compatible combination of surface coating in critical areas, and cathodic protection is recommended.

In order to further increase the life-time of sheet piling structures, different protection measures can be combined.

DURABILITY OF SHEET PILES

COATING

The classical corrosion protection for steel sheet piling is surface coating.
EN ISO 12944 deals with protection by paint systems and its various parts cover all the features that are important in achieving adequate corrosion protection.



DURABILITY OF SHEET PILES

COATING

In certain situations where there is no oxygen (deep under the ground) steel piling may not corrode. In most situations however, when exposed to the atmosphere in industrial or coastal area, to seawater, to freshwater, to polluted or disturbed ground, or to anaerobic bacteria, protection from corrosion is essential.

When water and oxygen are available, corrosion takes place by an electrochemical process. Coating systems are used to protect against corrosion as well as for decoration, but before a coating system is applied it is essential that the steel surface is properly prepared.

Surface Preparation

Hot-rolled steel has a surface oxide layer known as millscale. This bluish oxide layer is brittle and only partly adherent to the steel surface. When the steel is exposed to air and water, it corrodes rapidly in the areas not covered by millscale. The corrosion quickly spreads under the millscale, causing it to flake off. If steel covered with millscale is coated, the corrosion reaction still takes place under the coating, although at a slower rate. The result is eventual coating breakdown. For this reason, it is essential to remove the millscale before coating. Abrasive blasting with grit or shot is one of the most efficient ways of removing scale and is now the most frequently used method of cleaning steel. An additional advantage of abrasive blasting is that it roughens the steel surface, providing a good bond for the adhesion of coatings. This is particularly important for the heavy-duty coatings used for applications such as resistance against severe abrasion.

DURABILITY OF SHEET PILES

Blasting Standards

ISO 8501-1 is the internationally accepted standard for determining the degree of cleanliness of abrasive blast-cleaned steel. The steel surface is compared to a series of standard photographs. The most commonly used preparation grades are as follows:

ISO Sa 2,5	Very thorough blast cleaning
ISO Sa 3	Blast cleaning to visually clean steel

Surface Profile Measurement

There are several ways of measuring the profile of an abrasive-blasted surface. Accurate laboratory instruments give the best information and replicas of the surface can be made on site or in the shop and analyzed in the laboratory. The use of a surface-profile comparator is faster. These make use of stainless-steel discs which have been blasted to various profiles and are compared by sight and feel to the blasted surface. ISO 8503 specifies the requirements for surface-profile comparators for grit-blasted and shot-blasted surfaces. The most commonly used roughness measurement is the average peak-to-valley height, known as Rz. This is usually stated in microns (0.001 mm), and the heigher the value, the rougher the surface. The minimum and maximum acceptable Rz values depend on the coating system.

DURABILITY OF SHEET PILES

Coating Systems

A coating system generally consists of one or two primers, at least one intermediate coat, and a topcoat. The primer of a paint system for steel has a large influence on the anti-corrosive properties of the total system. It provides good adhesion to the surface, a mechanism of corrosion inhibition, and a good base for the intermediate and topcoats. A zinc primer is often chosen for its good corrosion-inhibiting properties.

The intermediate coat increases the total thickness and thus increases the distance for moisture diffusion to the surface. The topcoat is chosen for color and gloss retention, for chemical resistance, or for additional resistance to mechanical damage such as abrasion. Generally epoxies are used for seawater immersion and chemical resistance, polyurethanes for color and gloss retention.

Each project has differing requirements. In some cases, it may be possible to apply an entire system in the shop, in others, perhaps just one or two coats in the shop and the remainder on site. When a zinc primer is shop-applied, the application of a sealer has a number of advantages. These include easier removal of contamination, prevention of zinc-salt formation and easier topcoating on site. Systems are designed to meet varying project requirements. The determination of especially abrasive resistant and impact-resistant coatings was the goal of selective research and test programs run by ProfilARBED. The result was the specification of primer/sealer systems or one-coat systems that could be shop-applied to afterwards resist hard driving conditions due to their abrasive-resisting characteristics.

Long overcoating intervals and good corrosion resistance allow partial systems to be exposed on site for many months before the final coat(s) is (are) applied.

In the following, paint systems are proposed for different environments according to the classification of EN ISO 12944.

DURABILITY OF SHEET PILES

COATING

Atmospheric Exposure

In industrial and coastal regions, the corrosion process is accelerated by the presence of salt and/or industrial pollution-particularly sulfur dioxide. The life of conventional paints is rather short, resulting in frequent maintenance periods. The use of heavy-duty epoxy/polyurethane systems will extend time to first maintenance and reduce the overall cost of steel protection.
Sheet piling is often used in situations where part of it is exposed to the atmosphere, for example as a retaining wall. In such applications the aesthetical and functional look is important. A coal-tar-epoxy finish or a rusty surface are unlikely to be acceptable and so polyurethane finishes become an automatic choice. They combine gloss and color retention and the latest formulations are easy to apply and maintain.

Proposal (EN ISO 12944 – Table A4, corrosivity category C4)

Zinc silicate epoxy primer	
Recoatable epoxy intermediate coating	
Aliphatic polyurethane topcoat	
Nominal dry film thickness of the system	240 µm (9.45 mil)

Freshwater Immersion

Freshwater immersion service is usually less corrosive than in marine conditions, although in brackish water or polluted water conditions can still be quite severe.
There are often aesthetic considerations in fresh-water projects. For convenience here, a system has been chosen which is capable of performing well both above and below water.
This avoids the need to apply separate systems for above- and below-water areas, saving time and cost. The proposed system is tar-free and suitable for both immersion and atmospheric exposure. Where maximum color and gloss retention is required, a polyurethane finish may be applied as topcoat.

Proposal (EN ISO 12944 – Table A8, corrosivity category Im 1)

Primer	
Polyamine cured epoxy coating	
Nominal dry film thickness of the system	300 µm (11.80 mil)

DURABILITY OF SHEET PILES

COATING

Seawater Immersion

Structures continuously or partially immersed in seawater require careful attention. Abrasion and impact (direct or indirect) may damage the coating system and soluble salts from the sea will accelerate the rate of corrosion at the damaged areas.
For long-term performance in immersion there should be no compromise on quality. The specification must be clear and surface preparation must be good.
The application must be properly carried-out and inspected and, of course, the coating system must be of high quality. Cathodic protection is often specified in combination with a coating system and it is essential that the chosen coating system has been fully tested for compatibility.

Proposal (EN ISO 12944 – Table A8, corrosivity category Im 2)

Polyamide cured epoxy primer	
Polyamide cured coaltar epoxy coating	
Nominal dry film thickness of the system	450 µm (17.70 mil)

As an alternative, glass-flake-reinforced epoxy coating could be used with the appropriate primer and sealer.

DURABILITY OF SHEET PILES

COATING

Waste Disposal

Sheet piling is increasingly being used to isolate severely contaminated ground. It is also used to contain polluted soil which has been moved from other areas. Here an excellent standard of steel protection is essential. The coating system may have to protect the steel from highly acidic soil. It must have an outstandingly good chemical resistance and especially good resistance to mineral and organic acids. The system must also be able to withstand abrasion and impact.

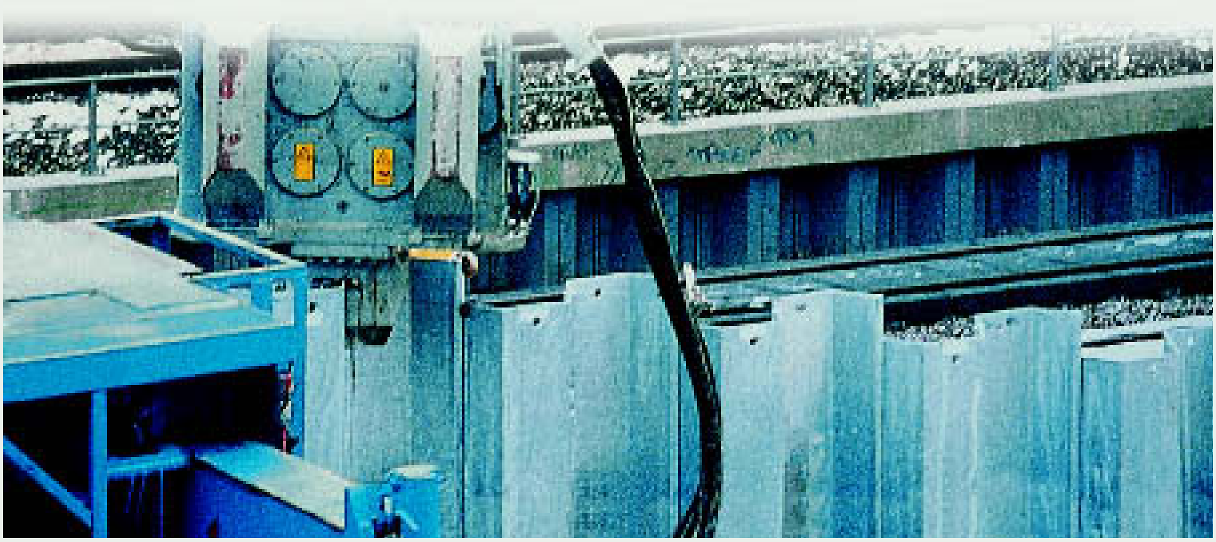
Proposal

Micaceous iron oxide pigmented polyamide cured epoxy primer
Polyamine cured epoxy coating with increased chemical resistance
Nominal dry film thickness of the system 480 µm (19.80 mil)

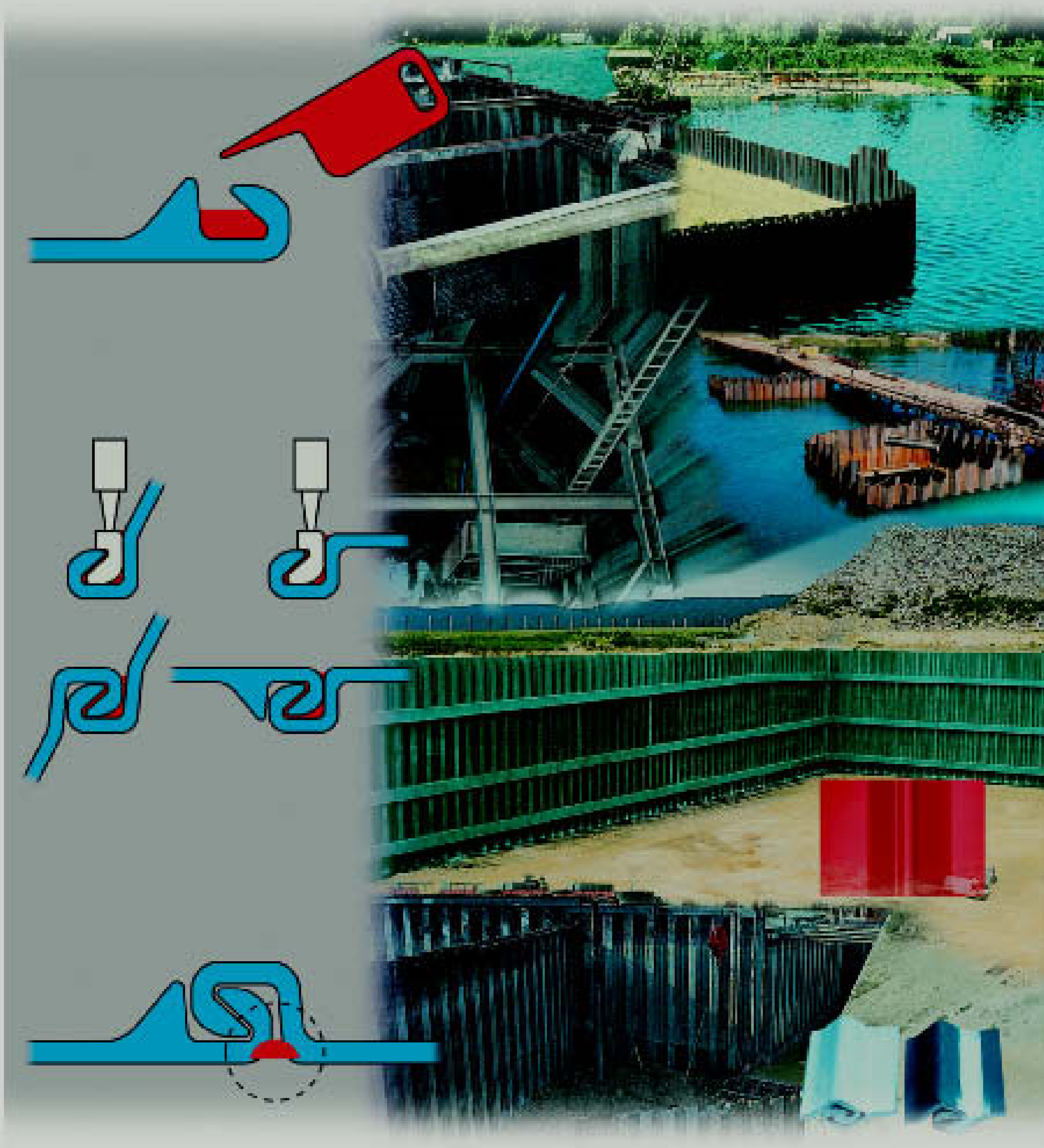
DURABILITY OF SHEET PILES

Hot-Dip Galvanizing

The procedure consists in dipping the steel to be coated into molten zinc, after adequate surface preparation, and thereby creating a steel-zinc alloy on the steel surface and providing a pure zinc coating outer surface.
For surface preparation, the steel is submitted to a pickling bath (acid) and a flux treatment (chlorides).
The zinc bath has a temperature of 450 °C (842° F) and the minimum thickness of the finished layer is 85 µm (3.3 mil), in compliance with EN ISO 1461.
If a paint system is applied on the zinc coating, it is referred to as a duplex solution.
Since galvanization of the finished product has an influence on the chemical analysis of the steel, the intention to galvanize must be specified in the purchase order. On the other hand, the intention to apply a paint system to the zinc coating should be indicated to the galvanizer.



WATERTIGHTNESS



WATERTIGHTNESS

THEORETICAL ASPECTS

The watertightness of the walls is one of the important selection criteria for construction processes in certain types of works, as for example: underground-parking areas, tunnels, waste containment, etc. Steel sheet piling, by definition the separation element between two different types of material, constitutes an ideal solution for resolving the problem of watertight walls provided it is possible to find:

– A method of precisely calculating the rate of flow through the interlocks,
– Solutions to the practical problems which arise during the construction of watertight walls.

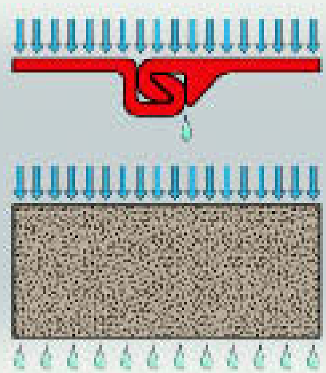
Calculation

ProfilARBED has carried out an exhaustive research program in collaboration with Delft Geotechnics for the assessment of the seepage resistance of steel sheet pile walls. The kind of flow is difficult to determine, but most likely it is not a porous-media type of flow and Darcy's law does not hold for the local seepage through a joint.

To accommodate this difficulty, the concept of ***Joint Resistance*** was introduced, a factor of proportionality between the discharge through a sheet pile interlock and the water pressure *(see EN 12063).*

Sheet pile

Porous medium



$$q_z = \rho \frac{\Delta p_z}{\gamma_w}$$

Where:

q_z	the discharge per unit length of joint at level z [m³/s/m]
Δp_z	the pressure drop at level z [kPa]
ρ	the inverse Joint Resistance [m/s] determined by tests
γ_w	the unit weight of water [kN/m³]

Watertightness requirements may e.g. be formulated as follows:

– The total flow into a building pit may be limited to a maximum allowable value,
– An imperviousness equivalent to a given concrete-wall thickness and permeability may be asked for.

The concept of Joint Resistance makes it possible to meet these requirements with a sheet pile wall (see also our special brochure 'The impervious steel sheet pile wall – Part I').

WATERTIGHTNESS

PRACTICAL ASPECTS

Sealing

For practical design purposes it is advisable to assess the degree of the required seepage resistance in order to select a cost-effective solution. Depending on the requirements, there are several possible solutions:

– In applications such as temporary retaining walls a moderate rate of seepage is often acceptable. A steel sheet pile wall made of piles with the famous Larssen interlock may provide sufficient seepage resistance ($\rho \leq 10^{-6}$ m/sec)

– In applications where a medium to high seepage resistance is required – such as cut-off walls for contaminated sites, retaining structures for bridge abutments and tunnels – double piles with a workshop-sealed or welded intermediate joint should be used.
  Filler materials are used to seal the intermediate joint of double piles in the workshop and/or the free interlock to be threaded on site.
  - The lower end of the resistance range is adequately served by a **bituminous filler (Beltan)** ($\rho \leq 6 \times 10^{-8}$ m/sec), but it is noted that its use is limited to water pressures less than 100 kPa (14.5 PSI).
  - For high resistance requirements, as well as water pressures up to 200 kPa (29 PSI), a **water-swelling product** should be used as a filler material. (**Roxan®** -System)* ($\rho \leq 3 \times 10^{-10}$ m/sec). The common interlock of double piles is tightened with a 2-component Polyurethan sealant.

– 100% watertightness may be obtained by **welding** every joint.
  Double piles with a workshop weld are used for the construction of the wall. The interlocks remaining to be threaded on site have to be welded after excavation to the greatest depth possible.

When aesthetic aspects are the most important feature, a special sealer may be used after installation of the sheet piles.
This polyurethane product fills the gap at the interlock and in contact with air transforms into a high-performance elastomer which may be ground and overcoated.
(See also our special brochure 'The impervious steel sheet pile wall – Part II')

* Roxan® is a trademark of ProfilARBED

Photograph of the Roxan®-System

DECLUTCHING DETECTION

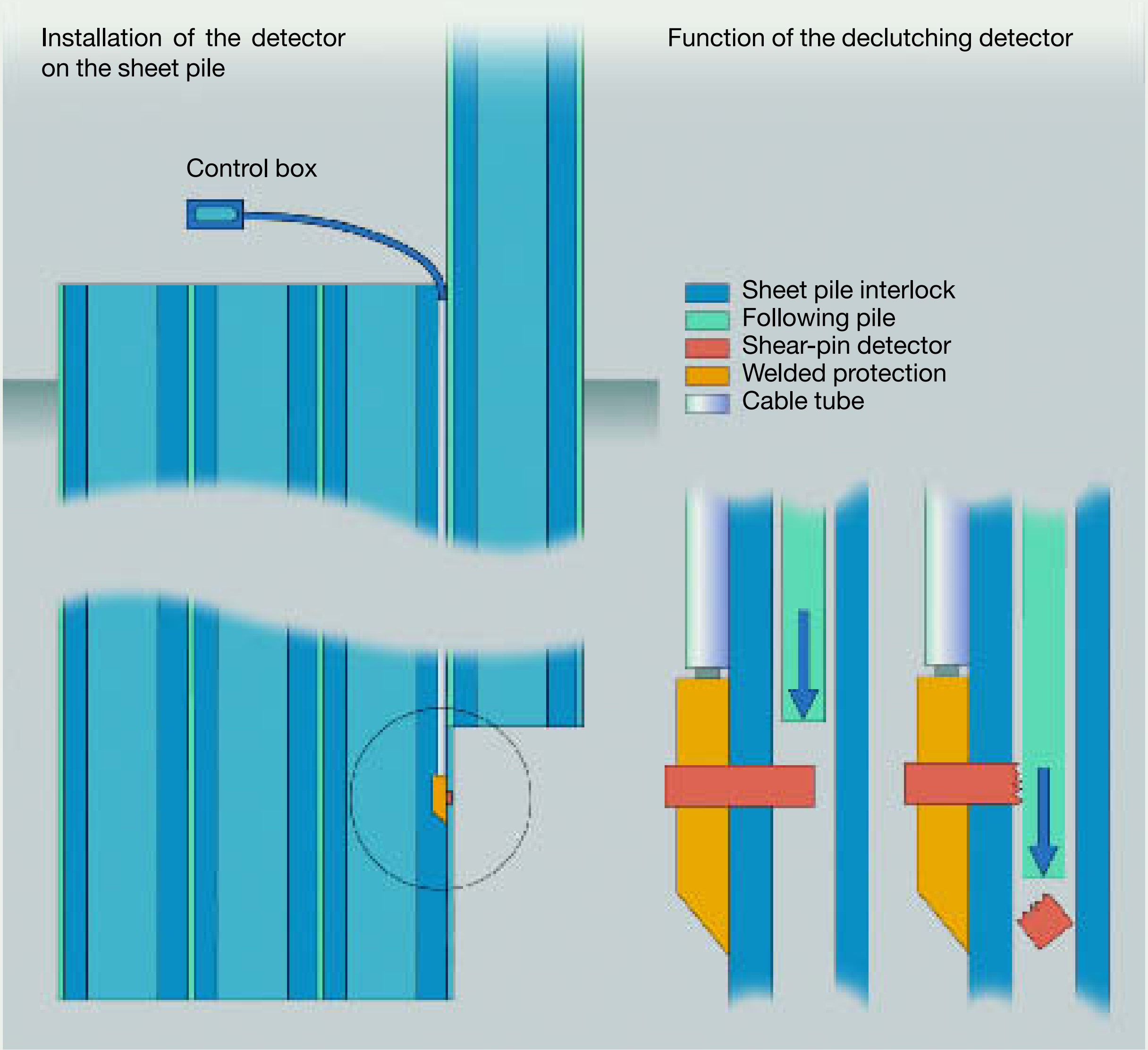
DECLUTCHING DETECTION

In critical conditions, where correct interlocking of the piles is a must and where difficult soil conditions could create a risk of declutching, special interlocking control devices may be installed for absolute safety.

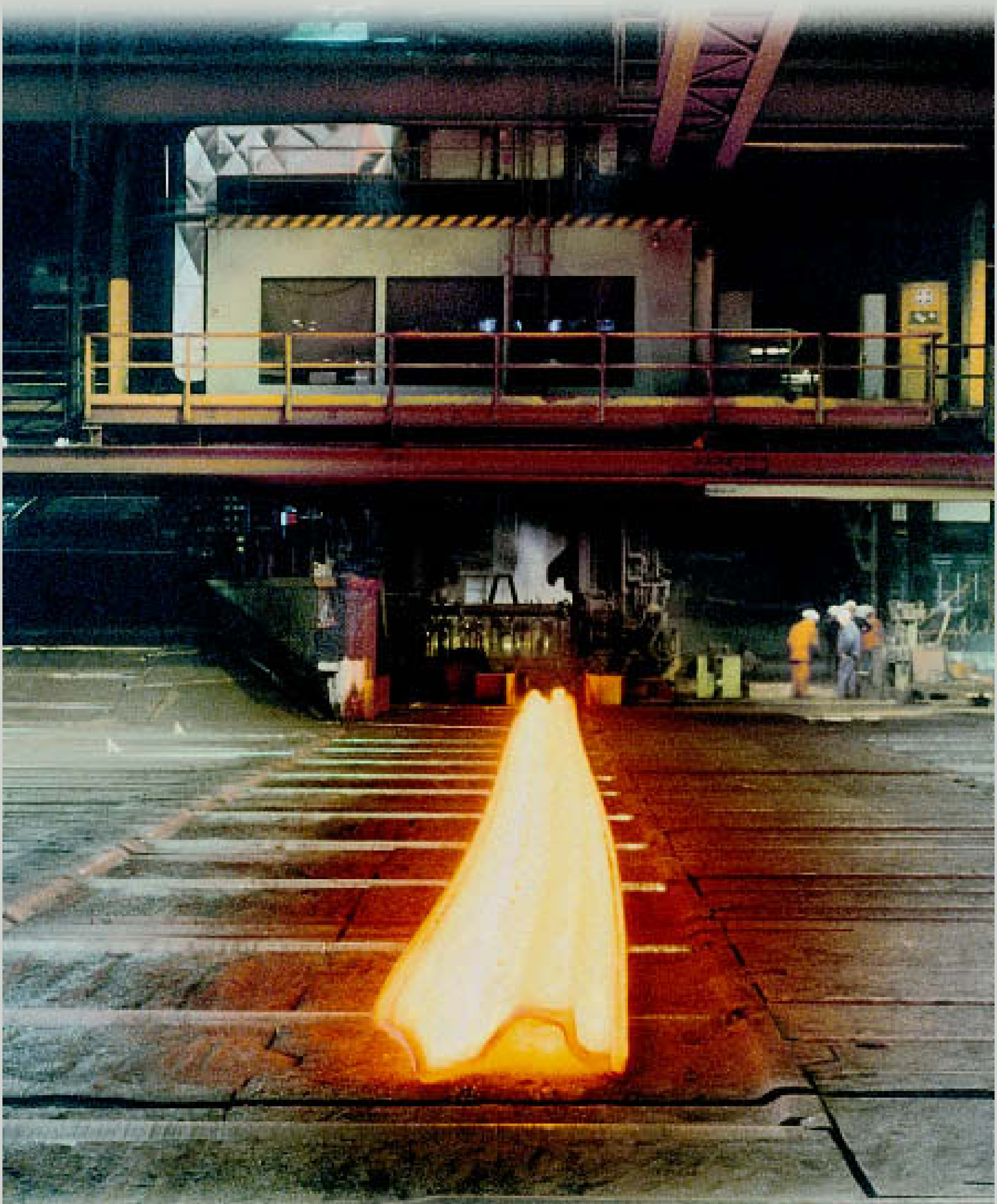
A detector fitted at toe level (or at other levels) in the front interlock of a sheet pile (in the driving direction) provides control of the interlocking with the following sheet pile.

The detector consists of a pin designed to allow the function to be checked after driving; it shears off, transmitting a signal to the surface by means of a cable fixed in a tube welded on the pile.

The detector has been designed to work in all kinds of environments, e.g. in salt water.



DELIVERY CONDITIONS



DELIVERY CONDITIONS

DELIVERY CONDITIONS

TOLERANCES AND ROLLING LENGTHS

Tolerances on Sheet Piles

Reference standard: EN 10248

Tolerances	AU, PU, LS, JSP	AZ	AS 500	HZ
Mass		± 5 %		
Length		± 8 in		
Height	≤ 8 in : ± 0.16 in	≤ 8 in: ± 0.20 in		± 0.20 in
	> 8 in : ± 0.20 in	8 in < ± 0.24 in < 12 in		
		≥ 12 in : ± 0.28 in		
Thickness		t, s ≤ 0.335 in:		t, s ≤ 0.492 in:
		± 0.02 in		+ 0.08 in / – 0.04 in
		t, s > 0.335 in:		t, s > 0.492 in:
		± 6 %		+ 0.10 in / – 0.06 in
Width		± 2 %		
Double Pile Width		± 3 %		
Straightness		0.2 % of the length		
Ends out of square		2 % b		

Reduced tolerances on request.

Maximum Rolling Lengths

Section	Length
AU – PU – LS – JSP	102 ft
AS 500	102 ft
AZ	102 ft
HZ	108 ft
RH / RZ	79 ft
OMEGA 18	52 ft
C9 / C14 / DELTA 13	59 ft

Longer sections available on request.

DELIVERY CONDITIONS

TOLERANCES AND ROLLING LENGTHS

Tolerances on Sheet Piles

Reference standard: EN 10248

Tolérances	AU, PU, LS, JSP	AZ	AS 500	HZ
Mass		± 5 %		
Length		± 200 mm		
Height	≤ 200 mm : ± 4.0 mm	≤ 200 mm : ± 5.0 mm		± 5.0 mm
	> 200 mm : ± 5.0 mm	200 mm < ± 6.0 mm < 300 mm		
		≥ 300 mm : ± 7.0 mm		
Thickness		t, s ≤ 8.5 mm :		t, s ≤ 12.5 mm :
		± 0.5 mm		+ 2.0 mm / – 1.0 mm
		t, s > 8.5 mm		t, s > 12.5 mm
		± 6 %		+ 2.5 mm / – 1.5 mm
Width		± 2 %		
Double Pile Width		± 3 %		
Straightness		0.2 % of the length		
Ends out of square		2 % b		

Reduced tolerances on request.

Maximum Rolling Lengths

Section	Length
AU – PU – LS – JSP	31.0 m
AS 500	31.0 m
AZ	31.0 m
HZ	33.0 m
RH / RZ	24.0 m
OMEGA 18	16.0 m
C9 / C14 / DELTA 13	18.0 m

Longer sections available on request.

DELIVERY CONDITIONS

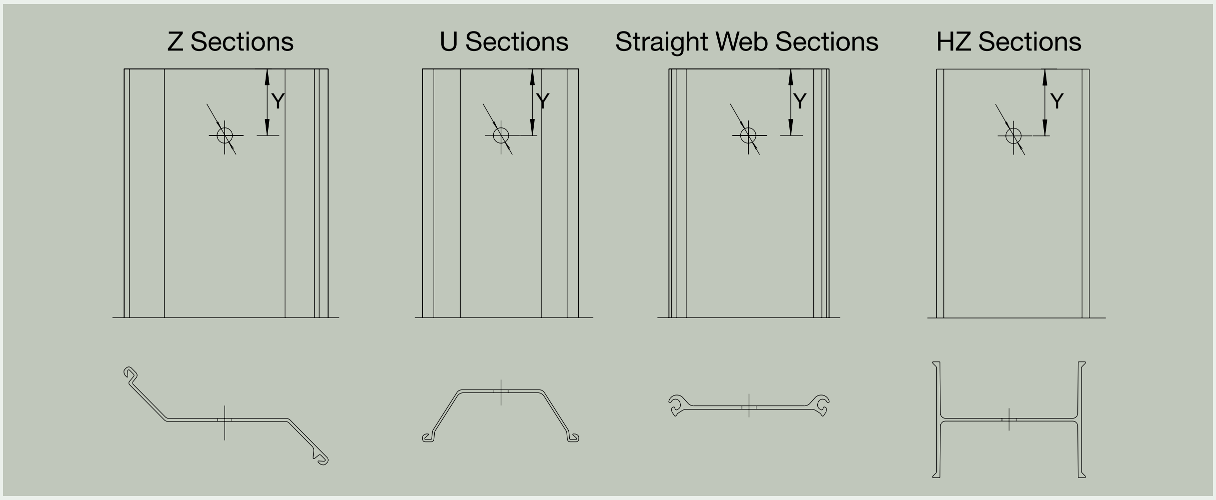
HANDLING HOLES AND MARKING

Handling Holes

Sheet pile sections are normally supplied without handling holes. If requested, they can be provided with handling holes in the centerline of the section.

Standard dimensions:	Ø = 50 mm;	Y = 200 mm	
	Ø = 50 mm;	Y = 250 mm	
	Ø = 40 mm;	Y = 75 mm	
	Ø = 40 mm;	Y = 300 mm	
	Ø = 2.5 in;	Y = 9 in	(Ø = 63.5 mm; Y = 230 mm)

Other dimensions on request.



Marking

The following markings can be supplied on request:

- color marks on the top of each pile defining section, length and steel grade
- adhesive stickers showing the name of the customer, the destination, the order number, the type and length of profile, ...

DELIVERY CONDITIONS

STEEL GRADES AND INSPECTION

Steel Grades

The standard we normally refer to regarding steel grades for hot-rolled sheet piles is EN 10248 Part 1. The mechanical properties and chemical composition are shown in the table below.

Grade	Min. yield point	Min. tensile strength	Min. elongation	Chemical composition (% max)					
			$L_o = 5.65 \sqrt{S_o}$						
	N/mm²	N/mm²	%	C	Mn	Si	P	S	N
S 240 GP	240	340	26	0.25	–	–	0.055	0.055	0.011
S 270 GP	270	410	24	0.27	–	–	0.055	0.055	0.011
S 320 GP	320	440	23	0.27	1.70	0.60	0.055	0.055	0.011
S 355 GP	355	480	22	0.27	1.70	0.60	0.055	0.055	0.011
S 390 GP	390	490	20	0.27	1.70	0.60	0.050	0.050	0.011
S 430 GP	430	510	19	0.27	1.70	0.60	0.050	0.050	0.011

For details see EN 10248, grade S 450 GP upon request

We can also provide steel grades complying with other standards. The table below compares the main standards used world-wide. For chemical composition, see the corresponding standard.

Reference standard	Comparable international standards		
EN 10248	ASTM	CSA	JIS
S 240 GP			
S 270 GP	A 328	Gr. 260 W	SY 295
S 320 GP		Gr. 300 W	
S 355 GP	A 572 Gr. 50; A 690	Gr. 350 W	
S 390 GP	A 572 Gr. 55		SY 390
S 430 GP	A 572 Gr. 60	Gr. 400 W	
S 450 GP	A 572 Gr. 65		

Grades S 450 GP, A 690 and A 572 Gr. 65 upon request

Materials to other specifications, such as special steels, steel with an improved corrosion resistance, or copper addition in accordance with EN 10248 Part 1 Chapter 10.4 can be supplied on request.

Grade A 690 with higher yield strength upon request.

If the steel sheet pile is to be galvanised, this must be specified in the purchase order as it has an influence on the chemical composition of the steel used.

It is recommended that when placing orders the purchaser inform the manufacturer of any surface treatment to be applied to the product after delivery.

DELIVERY CONDITIONS

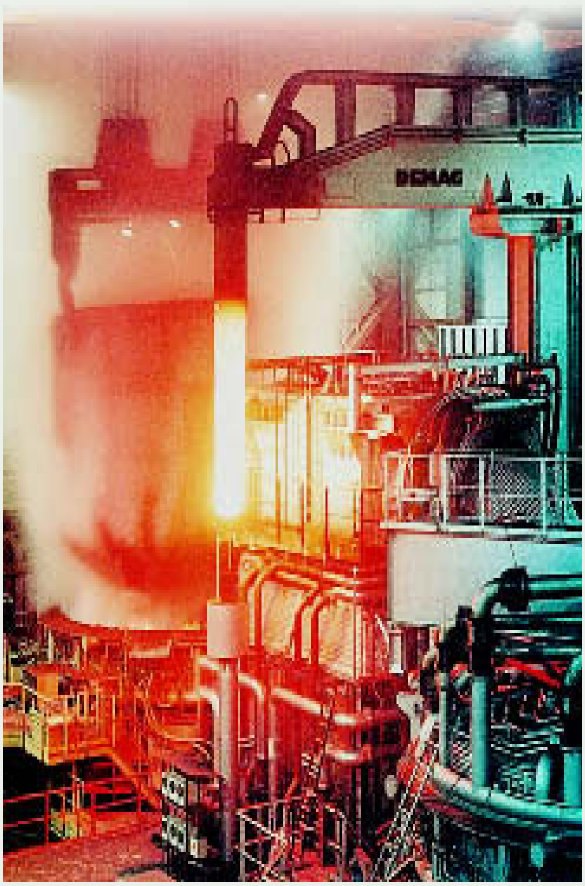
STEEL GRADES AND INSPECTION

Protecting the environment is everyone's concern

ProfilARBED's entire production is made from indefinitely recyclable scrap. The concept of "sustainable development" involves all the decision-making players in the group's environmental policy, which ensures that as much attention is paid to environmental concerns as to safety issues. Use of steel in construction limits the nuisance caused by building sites; factors such as noise, dust and the large surface areas involved, thus helping to restore a favourable energy balance : All our steel sheet piles are made out of 100% recycled steel, are re-usable and recyclable at the end of their lifetime. We have a full ISO 14001 certification.

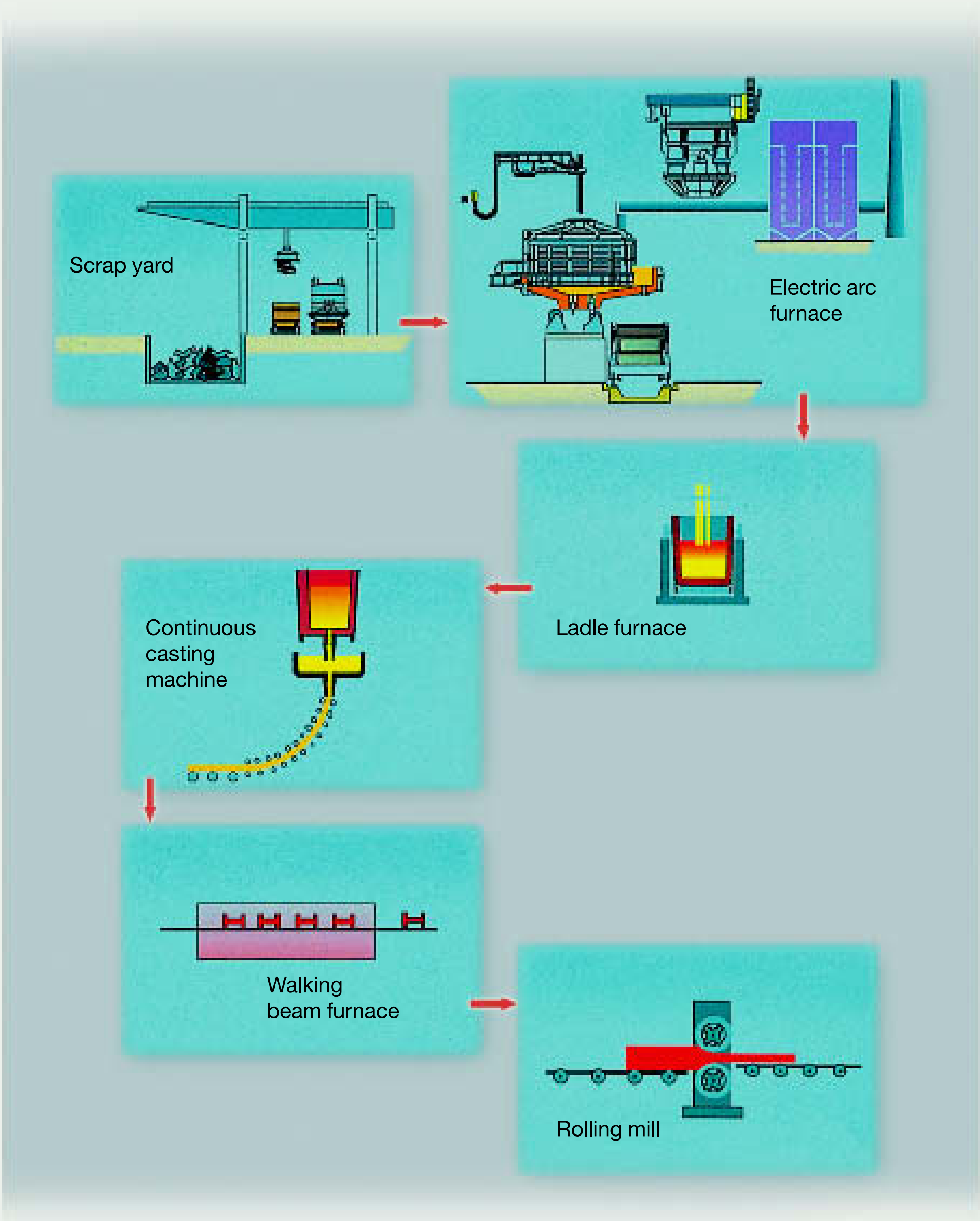
Inspection and Testing

Steel sheet piling can be supplied to the specifications of the customer or according to the prescriptions of a given standard.
Standard normally referred to for inspection and testing specification: EN 10248.
Standard normally referred to for certificates: EN 10204.



DELIVERY CONDITIONS

PRODUCTION LINE



HP PILES

HP steel bearing piles are special H beams with the same flange and web thickness. Bearing piles of this type are used all over the world for the deep foundations of various structures: high-rise buildings, industrial constructions, bridges, etc.

The most important of the multiple advantages are the following:

- Easy installation, considering driving as well as handling, transport and storing.
- No limits on the length of the pile, due to easy adaptation to soil conditions by splicing.
- Control of the bearing capacity by dynamic measurement during driving.
- Easy connection to the superstructure.
- Bending moment capacity for horizontal forces.
- Immediate loading after driving.
- Excellent durability; extensive experience with totally embedded piles has shown a corrosion rate tending to zero.

HP PILES

CHARACTERISTICS

Section	Mass	Dimensions				Steel area	Total area	Peri-meter	Moment of inertia		Section modulus		HISTAR [4])
	G	h	b	t_w	t_f	A	A tot = h x b	P	Iy	Iz	Wy	Wz	
	kg/m	mm	mm	mm	mm	cm^2	cm^2	m	cm^4	cm^4	cm^3	cm^3	
HP 200 x 43	42.5	200	205	9	9	54.14	410	1.180	3888	1294	388.8	126.2	
HP 200 x 53	53.5	204	207	11.3	11.3	68.14	422.3	1.200	4977	1673	488.0	161.7	
HP 220 x 57.2	57.2	210	224.5	11	11	72.85	471.5	1.265	5729	2079	545.6	185.2	
HP 260 x 75	75	249	265	12	12	95.54	659.9	1.493	10650	3733	855.1	281.7	
HP 260 x 87.3	87.3	253	267	14	14	111.2	675.5	1.505	12590	4455	994.9	333.7	
HP 305 x 79	78.4	299.3	306.4	11	11	99.9	917.1	1.780	16331	5278	1091	344.5	
HP 305 x 88 [1])	88	301.7	307.2	12.3	12.3	111.6	926.8	1.782	18380	5949	1218	387.3	
HP 305 x 95 [1])	95	303.8	308.3	13.4	13.4	121.7	936.6	1.788	20170	6552	1328	425.1	
HP 305 x 110 [1]) [2])	110	307.9	310.3	15.4	15.4	140.2	955.4	1.800	23550	7680	1530	495.0	Hi
HP 305 x 126 [1]) [2])	126	312.4	312.5	17.7	17.7	161.6	976.2	1.813	27540	9019	1763	577.2	Hi
HP 305 x 149 [1])	149	318.5	315.6	20.7	20.7	190.0	1005	1.832	33050	10870	2075	688.8	Hi
HP 305 x 180	180	326.7	319.7	24.8	24.8	229.3	1044	1.857	40970	13550	2508	847.4	Hi
HP 305 x 186 [1])	186	328.3	320.5	25.6	25.6	237.0	1052	1.861	42580	14090	2594	879.3	Hi
HP 305 x 223 [1])	223	338.0	325.4	30.5	30.5	285.0	1100	1.891	52840	17590	3127	1081	Hi
HP 320 x 88.5	88.5	303	304	12	12	112.7	921.1	1.752	18740	5634	1237	370.6	
HP 320 x 103	103	307	306	14	14	131.0	939.4	1.764	22050	6704	1437	438.2	Hi
HP 320 x 117	117	311	308	16	16	149.5	957.9	1.776	25480	7815	1638	507.5	Hi
HP 320 x 147	147	319	312	20	20	186.9	995.3	1.800	32670	10160	2048	651.3	Hi
HP 320 x 184	184	329	317	25	25	234.5	1043	1.830	42340	13330	2574	841.2	Hi
HP 360 x 84.3 [3])	84.3	340.0	367.0	10.0	10.0	107.3	1248	2.102	23190	8243	1364	449.2	
HP 360 x 109 [1]) [2])	109	346.4	370.5	12.9	12.9	138.9	1283	2.123	30620	10940	1768	590.7	
HP 360 x 133 [1]) [2])	133	351.9	373.3	15.6	15.6	168.5	1314	2.140	37730	13540	2144	725.3	Hi
HP 360 x 152 [1]) [2])	152	356.4	375.5	17.9	17.9	193.8	1338	2.153	43950	15810	2466	842.3	Hi
HP 360 x 174 [1]) [2])	174	361.5	378.1	20.4	20.4	221.7	1367	2.169	51020	18400	2823	973.5	Hi
HP 360 x 180	180	362.9	378.8	21.1	21.1	229.3	1375	2.173	53040	19140	2923	1011	Hi
HP 400 x 122	122	348	390	14	14	155.9	1357	2.202	34770	13850	1998	710.3	
HP 400 x 140	140	352	392	16	16	178.6	1380	2.214	40270	16080	2288	820.2	Hi
HP 400 x 158	158	356	394	18	18	201.4	1403	2.226	45940	18370	2581	932.4	Hi
HP 400 x 176	176	360	396	20	20	224.3	1426	2.238	51770	20720	2876	1047	Hi
HP 400 x 194	194	364	398	22	22	247.5	1449	2.250	57760	23150	3174	1163	Hi
HP 400 x 213	213	368	400	24	24	270.7	1472	2.262	63920	25640	3474	1282	Hi
HP 400 x 231	231	372	402	26	26	294.2	1495	2.274	70260	28200	3777	1403	Hi

[1]) Section conforming to BS4: Part1: 1993.
[2]) Sections also available according to ASTM A6-2000
[3]) Only after agreement
[4]) Sections marked Hi are available in HISTAR 420 and HISTAR 460 grades (see special HP catalogue for details).

Special delivery conditions:
The HP sections are delivered in steel grades compliant with EN 10025 and EN 10113. Delivery of other steel grades on request.
Minimum tonnage of 40 tons, for the sections HP 200 x 43; HP 200 x 53; HP 220 x 57,2; HP 260 x 75–87,3; HP 320 x 88.5–184; HP 400 x 122–231 (derivative section and grade).
Minimum tonnage of 5 tons for the sections HP 305 x 88–223; HP 360 x 109–180 (derivative section, grade, length).
Tolerances are in accordance with EN 10034. Delivery acc. to other tolerances upon request.

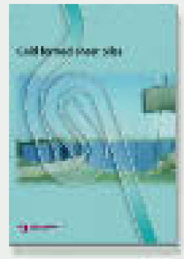
DOCUMENTATION

STEEL SHEET PILES / BEARING PILES

Sales Program
Ref. 1.3.03.1:
E; F; D; SP; NL;
RU; PL; P; I

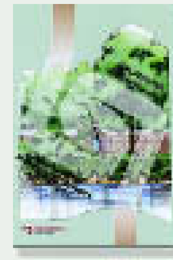
HZ Wall System
Ref. 1.4.02.1: E; F
1.4.01.1: D
1.14.01.1: US

Bearing Piles
Ref. 7.1.1.01.1: X



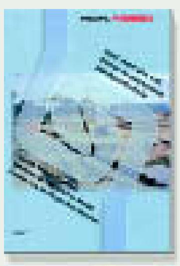
Cold Formed Sheet Piles
Ref. 1.6.03.1: E; F; D; NL

ISPC Services
Ref. 6.1.00.1: E; F; NL; SP



Aménagement berges
Ref. 3.31.98.1: D
3.31.02.1: F

Container Terminal Hamburg Altenwerder
Ref. 4.10.01.1: X

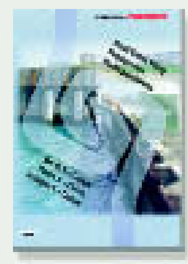


Munich Airport Extension
Ref. 4.16.01.1: X

Redevelopment of a landfill
Ref. 4.32.98.1: E; F; D

Donauhafen Straubing-Sand
Ref. 4.6.97.1: D

Tar Waste Disposal
Ref. 4.31.01.1: X

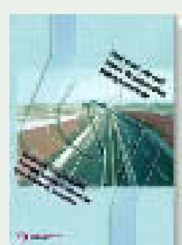


Berth 5 – Calais
Ref. 4.7.99.1: X

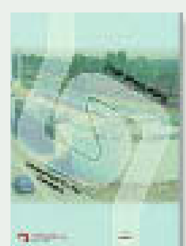
Les rideaux de palplanches dans la protection de canaux
Ref. 3.14.03.1: F; D

Harbour Construction
Ref. 4.1.03.1: X

Rail- and Motorway Construction 1 + 2
Ref. 4.14.97.1: X



Roadworks using sheet piles
Ref. 4.11.03.1: X



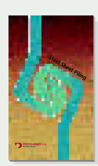
Underground Car Parks
Ref. 4.12.03.1: E; D; F

The Impervious SSP Wall Design
Ref. 2.1.03.1: E; F; D
Practical
Ref. 2.2.03.1: E; F; D

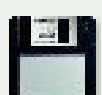
Dixeran Declutching detector
Ref. 2.5.01.1: X

Protection des palplanches en acier
Ref. 2.11.94.1: F; D

Installation of Steel Sheet Piles
Ref. 2.21.01: E; F; D



Pocket Program
Ref. 1.2.03.1: E



Design Disk

D = German	F = French	NL = Dutch	P = Portuguese	SP = Spanish	X = D; E; F or SP
E = English	I = Italian	PL = Polish	RU = Russian	US = Imperial Units	

DOCUMENTATION FAX TO ALC REQUEST

From

Company: ____________________

Name: ____________________

Address: ____________________

____

____

Phone/Fax: ____________________

E-mail: ____________________

Country: ____________________

To

ARCELOR LONG COMMERCIAL S.A.
Sheet Piling

66, rue de Luxembourg
L-4221 Esch/Alzette, Luxembourg
Phone (+352) 5313-3105
Fax (+352) 5313-3290

E-mail: sheet-piling@arcelor.com
http://www.alc.arcelor.com

Please send me the following documents

Reference	Title	Language

Fax this request to Arcelor Long Commercial +352 5313 3290

DOCUMENTATION FAX TO ALC REQUEST

From

Company: ____________________

Name: ____________________

Address: ____________________

City: ____________________

State: ____________________

Phone/Fax: ____________________

E-mail: ____________________

Country: ____________________

To

Skyline Steel Corporation

8, Woodhollow Road, Ste. 102 · Parsippany, NJ 07054
Technical Hotline: 1-866-8SKYLINE · 1-866-875.9546
Phone (973) 428-6100 · Fax (973) 428-7399
E-mail: skylinessp@aol.com · http://www.skylinessteel.com

Arcelor Long Commercial Sheet Piling

66, rue de Luxembourg · L-4009 Esch/Alzette, Luxembourg
Phone (+352) 5313-3105 · Fax (+352) 5313-3290
E-mail: sheet-piling@arcelor.com · http://www.alc.arcelor.com

Please send me the following documents

Reference	Title	Language

Fax this request to Skyline (973) 428-7399 or to Arcelor Long Commercial +352 5313 3290